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Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Volume 10 Number 16 / August 23, 1972

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page

01 Aerodynamics 2095
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 2097
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 2099
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 2101
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 2113
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 2116
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 2120
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

page

08 Computers 2126
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 2131
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 2135
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 2137
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 2138
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 2142
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 2153
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 2159
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 2163
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 2167
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

page

18 Materials, Nonmetallic 2171
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 2173
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2176
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2178
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2181
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 2182
Includes acoustics, Cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 2185
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 2189
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 2190
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 2193
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

page

28 Propulsion Systems 2193
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 2195
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 2197
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 2212
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 2216
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 2221
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

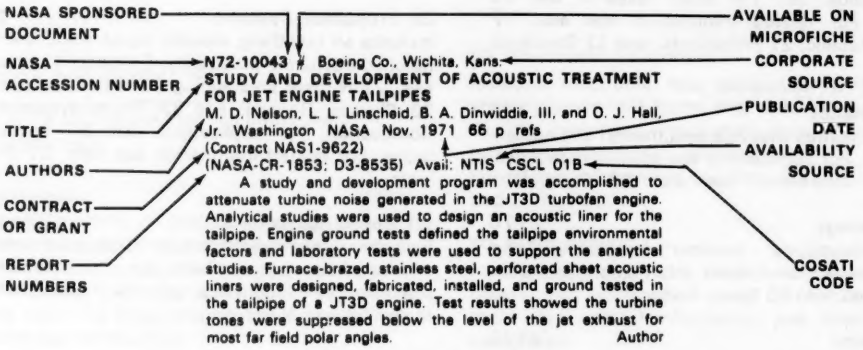
34 General 2224
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

page

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-47
CORPORATE SOURCE INDEX I-53
CONTRACT NUMBER INDEX I-65
REPORT/ACCESSION NUMBER INDEX I-67

TYPICAL CITATIONS AND ABSTRACTS

NASA CONTRACTOR REPORT CITATION AND ABSTRACT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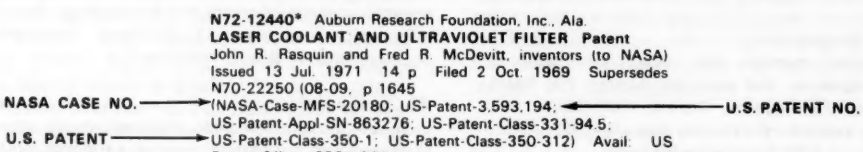
N72-10043 # Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

PATENT CITATION


NASA CASE NO.
U.S. PATENT CLASS NUMBERS
U.S. PATENT NO.
N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

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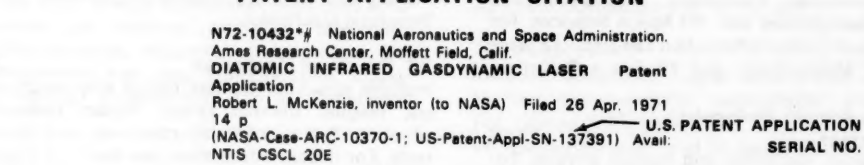
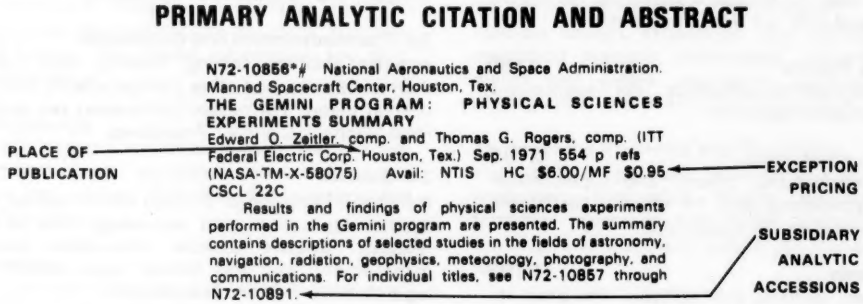

U.S. PATENT APPLICATION SERIAL NO.
N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

PRIMARY ANALYTIC CITATION AND ABSTRACT


PLACE OF PUBLICATION
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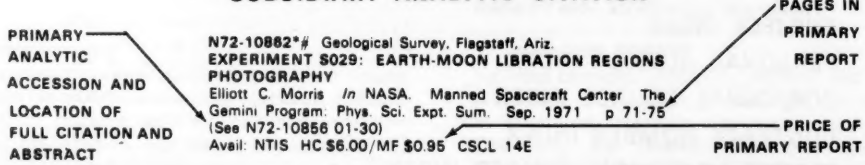
SUBSIDIARY ANALYTIC ACCESSIONS
N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp. Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C
Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

SUBSIDIARY ANALYTIC CITATION


PRIMARY ANALYTIC ACCESSION AND LOCATION OF FULL CITATION AND ABSTRACT
PAGES IN PRIMARY REPORT
PRICE OF PRIMARY REPORT
N72-10882*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 16 / AUGUST 23, 1972

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-24989 West Virginia Univ., Morgantown.
ANALYSIS OF A CIRCULATION CONTROLLED ELLIPTICAL AIRFOIL Ph.D. Thesis
Jack Peter Ambrosiani 1971 184 p
Avail: Univ. Microfilms Order No. 71-26650

A theoretical analysis on a 20% thickness/chord ellipse with circulation control by tangential trailing edge blowing is considered. The analysis yields the sectional lift and drag coefficients for given ambient conditions, flight conditions, and prescribed blowing reservoir conditions. The method of solution is an iterative one, and involves the matching of an assumed sectional lift coefficient with the sectional lift coefficient calculated from the actual pressure distribution over the body in the presence of trailing edge blowing. In order to obtain the pressure on the wall in the wall jet region a full-boundary layer analysis is required over the airfoil. The Karman-Pohlhausen integral method is used in the laminar region and the Nash and Hicks turbulent layer analysis is used in the turbulent region. This analysis confirms the feasibility of obtaining high lift coefficients with relatively low blowing rates. Dissert. Abstr.

N72-24990*# Techtran Corp., Glen Burnie, Md.
A VORTEX MODEL DEALING WITH THE AIRSTREAM AT THE ROTOR BLADE OF A HELICOPTER
W. H. Isay Washington NASA Apr. 1972 55 p refs Transl. into ENGLISH from "Ein Wirbelmodell zur Behandlung der Stroemung am Rotorblatt eines Hubschraubers", Inst. for Shipbuilding of the Univ. of Hamburg, report No. 272, Jul. 1971
(Contract NASw-2037)
(NASA-TT-F-14228; Rept-272) Avail: NTIS HC $4.75 CSCL 01A

With the aid of the nonstationary vortex line-support theory an approximate method is given for calculating the buoyancy distribution at rotor blades in forward flight. The theory presented takes into consideration, with reference to vortex geometry, a nonuniform (especially trapezoidal) flow through the plane of the rotor, as well as the unrolling process and the contraction of the free transverse vortex. In the determination of the circulation distribution of the rotor airflow, a special case is treated where the blades penetrate the unrolled and contracted tip vortex and root vortex of the sometimes forward-driving airfoils. Formulas for computing acoustic pressure fields radiated from a rotor (compressible treatment) are included. Author

N72-24991*# North Carolina State Univ., Raleigh.
FLIGHT TESTING TECHNIQUES FOR THE EVALUATION OF LIGHT AIRCRAFT STABILITY DERIVATIVES: A REVIEW AND ANALYSIS
Frederick O. Smetana, Delbert C. Summey, and W. Donald Johnson Washington NASA May 1972 113 p refs
(Contract NAS1-9603)
(NASA-CR-2016) Avail: NTIS HC $3.00 CSCL 01A

Techniques quoted in the literature for the extraction of stability derivative information from flight test records are reviewed. A recent technique developed at NASA's Langley Research Center was regarded as the most productive yet developed. Results of tests of the sensitivity of this procedure to various types of data noise and to the accuracy of the estimated values of the derivatives are reported. Computer programs for providing these initial estimates are given. The literature review also includes a discussion of flight test measuring techniques, instrumentation, and piloting techniques. Author

N72-24992*# Boeing Co., Renton, Wash.
PREDICTION OF UNSTEADY AERODYNAMIC LOADINGS CAUSED BY TRAILING EDGE CONTROL SURFACE MOTIONS IN SUBSONIC COMPRESSIBLE FLOW: ANALYSIS AND RESULTS
W. S. Rowe, B. A. Winther, and M. C. Redman Washington NASA Jun. 1972 77 p refs
(Contract NAS1-10536)
(NASA-CR-2003) Avail: NTIS HC $3.00 CSCL 01A

A theoretical analysis and a computer program have been developed for the prediction of unsteady lifting surface loadings caused by motions of trailing edge control surfaces having sealed gaps. The final form of the downwash integral equation has been formulated by isolating the singularities from the non-singular terms and establishing a preferred solution process to remove and evaluate the downwash discontinuities in a systematic manner. Comparisons of theoretical and experimental pressure data are made for several control surface configurations. The comparisons indicate that reasonably accurate theoretical pressure distributions and generalized forces may be obtained for a wide variety of control surface configurations. Spanwise symmetry or antisymmetry of motion, and up to four control surfaces on each half span can be accommodated. Author

N72-24993*# Scientific Translation Service, Santa Barbara, Calif.
EVALUATION OF FLIGHT MEASUREMENTS AND PLOTTING OF LOAD COLLECTIVES
H. Strehlow and N. Mihalcea Washington NASA May 1972 32 p refs Transl. into ENGLISH from Proc. of DGLR Symp. on Helicopters and Propellers, Immenstaad, West Germany, 24 Jun. 1969, report DLR-MITT-70-01, Dec. 1970 p 124-156
(Contract NASw-2035)
(NASA-TT-F-14283; DLR-MITT-70-01) Avail: NTIS HC $3.75 CSCL 01A

The practical application of computers to the development and flight testing of helicopters is discussed. By classifying the dynamic stresses and establishing the spectral power density of measured vibration curves, load collective and damage criteria are established. Potential applications in the solution of various serviceability problems are described. The evaluation methods used and the necessary employment of electronic data processing equipment are explained. Author

N72-24994*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SAFE ATMOSPHERE ENTRY OF AN ISOTOPE HEAT SOURCE WITH A SINGLE STABLE TRIM ATTITUDE AT HYPERSONIC SPEEDS

Lionel L. Levy, Jr. and Raymond K. Burns Washington Jun. 1972 50 p refs

(NASA-TN-D-6833; A-4342) Avail: NTIS HC $3.00 CSCL 01A

A theoretical investigation has been made to design an isotope heat source capable of satisfying the conflicting thermal requirements of steady-state operation and atmosphere entry. The isotope heat source must transfer heat efficiently to a heat exchange during normal operation with a power system in space, and in the event of a mission abort, it must survive the thermal environment of atmosphere entry and ground impact without releasing radioactive material. A successful design requires a compatible integration of the internal components of the heat source with the external aerodynamic shape. To this end, configurational, aerodynamic, motion, and thermal analyses were coupled and iterated during atmosphere entries at suborbital through superorbital velocities at very shallow and very steep entry angles. Results indicate that both thermal requirements can be satisfied by a heat source which has a single stable aerodynamic orientation at hypersonic speeds. For such a design, the insulation material required to adequately protect the isotope fuel from entry heating need extend only half way around the fuel capsule on the aerodynamically stable (wind-ward) side of the heat source. Thus, a low-thermal-resistance, conducting heat path is provided on the opposite side of the heat source through which heat can be transferred to an adjacent heat exchanger during normal operation without exceeding specified temperature limits. Author

N72-24995*# Naval Ordnance Lab., White Oak, Md.

A REVIEW OF SPHERE DRAG COEFFICIENTS APPLICABLE TO ATMOSPHERIC DENSITY SENSING

Maigonis V. Krumins 18 Jan. 1972 62 p refs

(NASA Order L-43531)

(NASA-CR-126742; NOLTR-72-34) Avail: NTIS HC $5.25 CSCL 01A

A comprehensive search has been performed on the drag coefficient of spheres in the Reynolds number range from 50 to 50,000 and for Mach numbers up to 5. This Reynolds-Mach number range corresponds to the range of interest in the falling sphere technique of atmospheric sensing. In this technique, the knowledge of the sphere's trajectory and its aerodynamic characteristics are utilized to obtain the density of the atmosphere. Presently available data have been collected and analyzed as to their validity and applicability to atmospheric density measurements. A new drag table is recommended for use in these measurements. Author

N72-24996# Aeronautical Research Labs., Melbourne (Australia).

A DYNAMICAL THEORY OF FLUTTER

A. E. Billington May 1971 14 p refs

(ARL/SM-332) Avail: NTIS HC $3.00

It is argued that no truly dynamical theory of flutter has been propounded. Ideas are limited to the elementary case of translation and rotation of a rigid wing. The motion of the wing and the motion of the air are incorporated in the one dynamical system. When the linear and angular deviations of the wing about a straight line fixed in space are small and when its motion is uniform in the absence of such deviations, the position of the wing is at any time determined by the solution functions of two simultaneous second order linear differential equations. These equations have constant coefficients when the motion is referred to moving axes fixed in the wing. The inclusion of a circulation term renders the equations nonhomogeneous by reason of its independence of motion and configuration. This term is reinterpreted as a periodic forcing function of the finite dynamical system represented by the equations. The amplitude and phase of the forcing function are synchronized with the circulation of an initial fluid motion--one intended to correspond to the onset of a flutter instability--in which the magnitude of the circulation is fixed by the Joukowski condition and in which the time rate of variation of the circulation is zero. These two conditions coupled with those of initially zero displacement variables constitute the four initial conditions to be satisfied by the solution of the pair of differential equations. Author

N72-24997# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

SOME MEASUREMENTS OF BASE PRESSURE FLUCTUATIONS AT SUBSONIC AND SUPERSONIC SPEEDS

D. G. Mabey London ARC 1972 21 p refs

(ARC-CP-1204) Avail: NTIS HC $3.25; HMSO 40p; PHI $1.85

Base pressure fluctuations were measured on three bodies. They were expressed in terms of a nondimensional spectrum function and a frequency parameter. The pressure fluctuation spectra for a body with a hemispherical nose and a 15 deg flare were independent of Mach number from 0.15 to 0.85 and corresponded fairly well with those measured previously on a cylindrical body which covered the limited Mach number range from 0.06 to 0.32. The base pressure fluctuations for a body with a flat nose and a plain 15 deg flare were considerably higher than those for the body with the hemispherical nose at subsonic speeds. The base pressure fluctuations for a body with a divided 15 deg flare were much higher than for the undivided flare, and displayed a distinct shedding frequency at subsonic speeds. At supersonic speeds, the base pressure fluctuations were smaller than at subsonic speeds and decreased as the Mach number increased. Author (ESRO)

N72-24998# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

A REVIEW OF SOME PUBLISHED DATA ON THE EXTERNAL-FLOW JET-AUGMENTED FLAP

D. H. Perry London ARC 1972 60 p refs Supersedes RAE-TR-70240; ARC-32714

(ARC-CP-1194; RAE-TR-70240; ARC-32714) Avail: NTIS HC $5.00; HMSO 90p; PHI $3.65

The data given in 13 NASA papers describing wind tunnel tests on external flow jet augmented flaps are reviewed. Details are given of the configurations tested and the main results achieved. Some of the data is compared with theoretical work done in the UK in support of internally ducted jet flap schemes. The application of jet flap theory to the correlation of maximum lift coefficients, based on considerations of leading edge loading, is given. Author (ESRO)

N72-24999# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN INVESTIGATION OF ANNULAR AEROFOILS FOR TURBOFAN ENGINE COWLS

C. Young London ARC 1972 91 p refs Supersedes RAE-TR-69285; ARC-32241

(ARC-R/M-3688) Avail: NTIS HC $6.75; HMSO £3.27; PHI $12.95

The annular aerofoils suitable for use as short fan cowls on turbofan engines of high bypass ratio have been tested at zero incidence over a range of subsonic Mach numbers and also in static conditions. Comparisons are presented with experimental results from a conventional type of pipe rig, and with predictions from a linearized and a nonlinearized theory. The results show that the effect of the cowl afterbody is fairly small and can be calculated theoretically. Both types of theoretical methods give

good predictions of the surface pressure distribution, but the comparison between theoretical and measured mass flow through the cowl deteriorates as Mach number increases.

Author (ESRO)

N72-25000# Cambridge Univ. (England). Dept. of Engineering.
THE UNSTEADY RESPONSE OF AN AXIAL FLOW COMPRESSOR WITH A DISTORTED INLET FLOW
H. Mokelke London Aeron. Res. Council 1972 46 p refs Supersedes ARC-32372
(ARC-CP-1203; ARC-32372) Avail: NTIS HC $4.50; HMSO 75 p; PHI $3.15

The response of a 4-stage axial flow compressor with a hub/tip ratio of 0.8 is investigated with a 60 deg square wave inlet distortion and with a triangular spoiler configuration inlet distortion. By measuring the total pressures, static pressures, and yaw angles behind each stage, the development of the distortion is followed through the compressor. ESRO

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-25001 Washington Univ., St. Louis, Mo.
THE METHOD OF MULTIBLADE COORDINATES IN THE LINEAR ANALYSIS OF LIFTING ROTOR STABILITY AND GUST RESPONSE Ph.D. Thesis
Sheng-Kuang Yin 1971 202 p
Avail: Univ. Microfilms Order No. 71-27371

The dynamic linearized or perturbation problem of a lifting rotor with rigid flapping blades having elastic restraints, with rigid hub and with four types of control feedback is solved for low and high rotor advance ratios with the method of multiblade generalized coordinates, using the Floquet state transition matrix. While previous applications of multiblade coordinates were limited to the use of the first cyclic flapping or in-plane modes and to constant coefficient rotor representations, the present study extends this work to include coning, differential coning and warping rotor modes and considers the periodicity of the coefficients in the dynamic rotor equations. The conventional modal columns now become time functions. Numerical examples assuming several blades per rotor show considerable differences in the modal function columns and in the gain factors at the stability limits depending on the number of blades.

Dissert. Abstr.

N72-25002 Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).
STATISTICAL ANALYSIS OF MISSION-PROFILE PARAMETERS OF TRANSPORT AIRPLANES [STATISTISCHE AUSWERTUNG VON PARAMETERN FUER EINSATZ-PROFILE VON TRANSPORTFLUGZEUGEN]
O. Buxbaum and P. Reinhold 1971 41 p refs In GERMAN
(TB-88; CAF-Doc-582) Copyright. Avail: Issuing Activity

The cumulative frequency distributions of the following mission profile parameters of different types of transport airplanes are shown: flight time, airplane take-off weight, airplane landing weight, and fuel weights during take-off and landing. Examples of jet powered short-, medium-, and long-range passenger and cargo airplanes are used to demonstrate that the obtained results can be used for the design of other similar airplanes.

Author

N72-25003# National Transportation Safety Board, Washington, D.C.
AN ANALYSIS OF AIRCRAFT ACCIDENT DATA: US GENERAL AVIATION 1969
29 Mar. 1971 22 p
Avail: NTIS HC $3.25

An analysis of the aircraft accidents occurring within the category of U.S. general aviation for calendar year 1969 is presented. The subjects discussed are: (1) growth of general aviation, (2) accident data, (3) accident analysis by type of flying, (4) accident analysis by accident type, (5) collisions between aircraft, and (6) accident analysis by cause and related factor.

Author

N72-25004# National Transportation Safety Board, Washington, D.C.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA: US GENERAL AVIATION, CALENDAR YEAR 1969
28 Apr. 1971 155 p
(NTSB-ARG-71-1) Avail: NTIS HC $9.75

The Annual Review of Aircraft Accident Data is a statistical compilation published by the National Transportation Safety Board. The publication contains statistical information compiled from reports of 4,767 general aviation accidents that occurred during the calendar year 1969. Included in the total number of accidents are 45 collisions between aircraft. By coding each aircraft involved in the collisions, an additional 45 records are produced, bringing the total accidents records to 4,812. This figure reflects the true number of pilots and aircraft involved in the accidents.

Author

N72-25005*# Hamilton Standard, Windsor Locks, Conn.
COMPUTER PROGRAM USER'S MANUAL FOR ADVANCED GENERAL AVIATION PROPELLER STUDY
Rose Worobel Washington NASA May 1972 76 p refs
(Contract NAS2-6477)
(NASA-CR-2066) Avail: NTIS HC $3.00 CSCL 01B

A user's manual is presented for a computer program for predicting the performance (static, flight, and reverse), noise, weight and cost of propellers for advanced general aviation aircraft of the 1980 time period. Complete listings of this computer program with detailed instructions and examples of input and output are included.

Author

N72-25006# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT, SOUTHERN AIRWAYS, INCORPORATED, DC-9, N97S, TRI-STATE AIRPORT, HUNTINGTON, WEST VIRGINIA, 14 NOVEMBER 1970
14 Nov. 1970 80 p
(NTSB-AAR-72-11) Avail: NTIS HC $6.00

A DC-9, N97S, operating as a charter flight, crashed during a landing attempt at the Tri-State Airport, Huntington, West Virginia, on November 14, 1970. All 75 occupants, including 71 passengers and four crewmembers, were fatally injured. The aircraft was destroyed. The flight was attempting a nonprecision instrument landing approach at the time of the accident. The crash occurred following impact with trees on a hill approximately 1 mile west of the runway threshold. The probable cause of this accident was the descent below minimum descent altitude during a nonprecision approach under adverse operating conditions, without visual contact with the runway environment. The Board has been unable to determine the reason for this descent although the two most likely explanations are (1) improper use of cockpit instrumentation data, or (2) an altimetry system error.

Author

N72-25007# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Flight Test Engineering Div.
EC-130E RADOME COMPATIBILITY TEST
Richard Solem and Philip P. Panzarella Oct. 1971 37 p
(ENEA-71-45) Avail: NTIS HC $4.00

The results of flight tests for determining the effects of installing an X band nose radome in an EC-130E aircraft are reported for takeoff, climb, and cruise. The changes in stability and control characteristics of the modified aircraft were also investigated. It was found that the redesigned nose section changed the airspeed error correction at takeoff by one knot, and by four knots for the landing configuration. The stall speed is also four knots higher than for the basic C-130E. The degradation in cruise performance was 10 to 11% and for climb performance was 15 to 16%. It is recommended that the air speed calibration data be used to update flight manuals, and that performance flight tests be conducted to determine the degradation within + or - 1%. F.O.S.

N72-25008# Xonics, Inc., Van Nuys, Calif.
VORTEX OBSERVATIONS BY THE XONICS ACOUSTIC RADAR AT NAFEC Final Report
Martin Balser, Arthur E. Nagy, and Andrew P. Proudian Dec. 1971 123 p
(Contract DOT-FA71WA-2672)
(FAA-RD-71-103; TR-7) Avail: NTIS HC $8.25

A series of flight tests was conducted in order to demonstrate feasibility of the concept of the Xonics acoustic vortex detector. The first tests consisted of simultaneous observations in close proximity by both the Xonics equipment and the instrumented tower of vortices shed by a low-flying aircraft. Except for the few cases where data was lost through equipment misalignment or malfunction or operator error, vortex returns were observed on virtually all of the runs. A total of 55 runs, which represents a substantial fraction of all of the data gathered, were selected for analysis. The vortex velocity measurements exhibit a clear correlation with aircraft configuration, and appear to confirm their use as a valid indicator of vortex intensity. Author

N72-25009# Bristol Univ. (England).
A METHOD OF IMPROVING AIRCRAFT GROUND PERFORMANCE IN SLUSH AND WET CONDITIONS
R. V. Barrett London ARC 1972 25 p refs Supersedes ARC-33108
(ARC-CP-1206; ARC-33108) Avail: NTIS HC $3.25; HMSO 45p; PHI $1.95

A small wheel placed ahead of an aircraft main landing wheel can effectively clear a path for it through slush or standing water. In this investigation, model pneumatic wheels of 9 in and 3 in diameter were used to determine the effect of the forewheel on the drag and spray from the main wheel and on its aquaplaning characteristics. The model was run at speeds up to 115 ft per sec in a water depth of 0.25 in on a moving runway apparatus. Total wheel drag was reduced by the auxiliary wheel except at very low speeds, the maximum reduction of nearly 50% occurring just below the normal aquaplaning speed of the main wheel. Aquaplaning of the main wheel only occurred after the auxiliary wheel had aquaplaned. This could be prevented by using a very high auxiliary wheel tyre pressure. The height of the intense region of the main spray plume was considerably reduced. Author (ESRO)

N72-25010# British Aircraft Corp., Preston (England). Flight Simulation Section.
A SIMULATOR STUDY OF DIRECT LIFT CONTROL
A. G. Barnes, D. E. Houghton, and C. Colclough London Aeron. Res. Council 1972 68 p refs
(ARC-CP-1199) Avail: NTIS HC $5.50; HMSO £1; PHI $3.90

A fixed base simulator study of direct lift control as applied to the VC-10 aircraft is described. The practical limitations imposed by factors such as the small spoiler authority to control lift, the power control dynamics, and the c.g. range over which the system must operate are included. A degree of improvement in longitudinal handling can be obtained from DLC, but it seems from this work that the most promising arrangement lies in a combination of DLC and a 'manoeuvre boost' input to the elevator. Confirmation by flight trials of the improved performance in the landing flare is needed, because of the difficulties of simulating this phase of flight. Author (ESRO)

N72-25011# Boeing Co., Renton, Wash. Commercial Airplane Group.
STUDY COVERING CALCULATIONS AND ANALYSIS OF SONIC BOOM DURING OPERATIONAL MANEUVERS. VOLUME 1: ANALYSIS AND COMPUTATION OF MANEUVER EFFECTS Final Report, Apr. 1970 - Feb. 1971
Feb. 1971 313 p refs
(Contract DOT-FA70WA-2315)
(AD-735296; D6A-12108-1-Vol-1; EQ-71-2) Avail: NTIS CSCL 01/2

The methods and results of the study of the effects of operational SST maneuvers on sonic boom are contained in three volumes. Volume I shows that the theoretical effects of operational maneuvers due to typical SST maneuvers are small except for maneuvers at Mach numbers below about Mach 1.3. Methods are outlined for applying the results to any airplane, and selected pressure signatures are presented for the U.S. SST and SCAT 15-F. Author (GRA)

N72-25012# California Inst. of Tech., Pasadena. Dept. of Applied Mathematics.
FINITE AMPLITUDE WAVES ON AIRCRAFT TRAILING VORTICES
D. W. Moore Oct. 1971 27 p refs
(Contract AF-AFOSR-1804-69; AF Proj. 9781)
(AD-737859; AFOSR-72-0033TR) Avail: NTIS CSCL 01/2

Numerical methods are used to study the growth of waves of finite amplitude on a pair of parallel infinite vortices. The vortices are treated as lines except where the detailed structure of the core is needed to remove consistently the singularity in the line integrals for the velocities of the vortices. It is shown that the vortices eventually touch and the shape of the wave at this instant is calculated. Wave distortion and gross properties are related to linear theory. GRA

N72-25013# National Transportation Safety Board, Washington, D.C.
AIRCRAFT INCIDENT REPORT: NORTHEAST AIRLINES, INCORPORATED, MCDONNELL DOUGLAS DC-9-31, N982NE, MARTHA'S VINEYARD, MASSACHUSETTS, 22 JUNE 1971
29 Dec. 1971 19 p
(PB-207101; NTSB-AAR-72-4) Avail: NTIS HC $3.00 CSCL 01B

On June 22, 1971, a DC-9-31 struck the water during a nonprecision instrument approach and received minor damage. There were no injuries to the three passengers and five crew members aboard the aircraft. The weather at the airport was reported to be: sky obscured; indefinite ceiling 300 feet; visibility 1 mile in fog; wind 030 at 5 knots; and the altimeter was 29.81 inches of mercury. The flight was performing a VOR straight-in approach to Runway 24 at Martha's Vineyard at the time of the incident. The aircraft struck the water approximately 3 miles short of the runway. Minor structural damage was incurred by the lower aft section of both engines. The National Transportation Safety Board determines that the probable cause of this incident was the lack of crew coordination in monitoring the altitude during the performance of a nonprecision instrument approach, the misreading of the altimeter by the captain, and lack of altitude awareness on the part of both pilots. Author (GRA)

N72-25014# European Research Office, London (England).
THE WG.13 LYNX HELICOPTER: SUMMARY OF LECTURES PRESENTED AT THE ROYAL AERONAUTICAL SOCIETY
Richard L. Scharpf 2 Feb. 1972 19 p refs Conf. held at London, 13 Jan. 1972
(AD-737611; ERO-1-1972) Avail: NTIS CSCL 01/3

The report covers the historical background through the development stage and discusses the achievement up to approximately December 1971. The new design features such as the rotor head, rotor blade, transmission and the Rolls Royce 360 engine are covered in more detail. The functions of the

Automatic Flight Control System are also discussed. Flight test progress is also discussed. Author (GRA)

N72-25015# Boeing Co., Seattle, Wash. Aerospace Group.
COCKPIT GEOMETRY EVALUATION. VOLUME 1: PROGRAM DESCRIPTION AND SUMMARY Final Report, 1 Feb. - 31 Aug. 1970
Patrick W. Ryan Nov. 1971 143 p refs
(Contract N00014-68-C-0289; NR Proj. 213-065)
(AD-738006; D162-10125-2A-Vol-1; JANAIR-701213-Vol-1)
Avail: NTIS CSCL 01/3

The Cockpit Geometry Evaluation Program is an experimental development to establish a standardized method for evaluating the physical geometry of a crew station. It evaluates the physical compatibility of a seated crew member of any size with any crew station beginning with the design concept. Data on the geometry of the crew station, the anthropometric characteristics of the crew members, and the sequence of tasks to be performed are stored in a computer. Mathematical routines provide dynamic movement for a variable-sized mathematical man-model. Numerical performance indicators, identification of physical and visual interferences, and reach infeasibilities are output. The crew station compliance with certain MIL-STD and -SPEC requirements is also checked. Volume I of the final report summarizes the results and techniques of Phases I, II and II-A. For Volume 2, see N71-19818. Author (GRA)

N72-25016# Boeing Co., Seattle, Wash. Aerospace Group.
COCKPIT GEOMETRY EVALUATION. VOLUME 3: COMPUTER PROGRAM Final Report, 1 Feb. - 31 Aug. 1970
Robert Katz, Ann Rice, and Elsie I. Nakagawa Nov. 1971 796 p refs
(Contract N00014-68-C-0289; NR Proj. 213-065)
(AD-738007; D162-10127-2A-Vol-3; JANAIR-701214-Vol-3)
Avail: NTIS CSCL 01/3

The Cockpit Geometry Evaluation (CGE) Program is a development of improved methods for evaluating the physical compatibility of crew members with crew stations. The heart of the program is a 23-joint, three-dimensional man-model (BOEMAN) that simulates the motion of humans performing tasks in a given environment. The computer program system (CPS) ties the project together. The system uses an updatable bank of anthropological, environmental and task sequence data. The system provides information concerning data consistency, reach capability, crew station compliance to select military standards, locations and orientations of joints and body segments during movement, visual and/or physical interference of BOEMAN with the crew stations and with himself, numerical performance data on joint displacement and deflection, and mass displacements. Author (GRA)

N72-25017# Boeing Co., Seattle, Wash. Aerospace Group.
COCKPIT GEOMETRY EVALUATION. VOLUME 4: MATHEMATICAL MODEL Final Report, 1 Feb. - 31 Aug. 1970
Michael J. Healy Nov. 1971 110 p refs Revised
(Contract N00014-68-C-0289; NR Proj. 213-065)
(AD-738008; D162-10128-2A-Vol-4; JANAIR-701215-Vol-4)
Avail: NTIS CSCL 01/3

This volume describes the mathematical man-model of Phase II-A of the Cockpit Geometry Evaluation (CGE) Program and replaces the contents of the Phase II volume (D162-10128-2). The CGE Program is developing a computerized method to evaluate the physical compatibility of crew members with crew stations beginning with the conceptual phases of the design. A link system enclosed by geometrical shapes has been developed to date to model any specified sized member of a human population. The majority of the link connecting points represent major joint centers of the body and the geometric shapes, based on anthropometric data, represent body segments. Author (GRA)

N72-25018# Boeing Co., Seattle, Wash. Aerospace Group.
COCKPIT GEOMETRY EVALUATION. VOLUME 5: VALIDATION
Patrick W. Ryan, Harland N. Sather, and Arthur W. Bearse Nov. 1971 192 p refs Revised
(Contract N00014-68-C-0289; NR Proj. 213-065)
(AD-738009; D162-10129-2A-Vol-5; JANAIR-701216) Avail: NTIS CSCL 01/3

The Cockpit Geometry Evaluation (CGE) Program is developing improved methods of evaluating the interaction and compatibility of crew members with new stations. The main feature is a computer program system (CGECPS) containing a 23-joint, three-dimensional man-model (BOEMAN) which can mathematically simulate human motion. During Phase II-A, an existing cockpit design (A-7E) was partially evaluated by the CGECPS. The results were compared with human factors data and the CGE system correctly analyzed more than 80% of the tasks performed. The validation of the man-model joint movement parameters was also continued in Phase II-A by comparing them with human movement parameters. The comparison results indicated that the Phase II-A man-model developments which were primarily oriented towards improving the computer efficiency of the man-model have also improved the accuracy of the man-model. Author (GRA)

N72-25969*# Martin Marietta Corp., Baltimore, Md.
PILOT SAFETY FOR THE X-24A LIFTING BODY VEHICLE
John Cochrane and Kenneth Graham *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 87-95 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-25019* Spectrolab, Inc., Sylmar, Calif.
APPARATUS FOR APPLYING COVER SLIDES Patent
Robert L. Oliver and Edward F. Zimmerman, inventors (to NASA) Issued 4 Apr. 1972 6 p Filed 28 Jan. 1970 Supersedes N70-25621 (08 - 12, p 2214) Sponsored by NASA
(NASA-Case-NPO-10575; US-Patent-3,654,036;
US-Patent-Appl-SN-6615; US-Patent-Class-156-510;
US-Patent-Class-156-250) Avail: US Patent Office CSCL 10A

Apparatus is described for applying thin glass slides to solar cells in an assembly line manner including a conveyor belt, a cartridge feeder, and rollers for feeding a long strip or coil of thin flexible glass. The cells and sheet are sprayed with an adhesive, moved through a drying chamber, and moved together by rollers that press down the glass sheet. After the strip and cells have been pressed together, they pass through a drying chamber. The strip is separated by applying hot wires to the strip around each cell and breaking the strip at these parting lines.
Official Gazette of the U.S. Patent Office

N72-25020* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYNCHRONOUS ORBIT BATTERY CYCLER Patent
David A. Baer, inventor (to NASA) Issued 16 May 1972 7 p Filed 3 May 1971 Supersedes N72-10066 (10 - 01, p 11)
(NASA-Case-GSC-11211-1; US-Patent-3,663,938;
US-Patent-Appl-SN-139528; US-Patent-Class-320-48;
US-Patent-Class-235-92T; US-Patent-Class-307-141.8;
US-Patent-Class-324-29.5) Avail: US Patent Office CSCL 10C

The development of an electric circuit which alternately connects an electric battery to a battery charger and load for

simulating charge and discharge characteristics of similar battery mounted in an artificial satellite is discussed. The device is controlled by an incremental clock and a clock frequency control which operate through a logic circuit and a comparator to energize a discharge time counter. First and second different states are created in response to timed pulses to produce the desired effect. P.N.F.

N72-25021* Philco-Ford Corp., Newport Beach, Calif.
MECHANICALLY EXTENDIBLE TELESCOPING BOOM Patent
Wilfred H. Bachle, inventor (to NASA) Issued 30 May 1972 11 p Filed 4 Feb. 1970 Supersedes N70-25674 (08 - 12, p 2147) Sponsored by NASA
(NASA-Case-NPO-11118; US-Patent-3,666,120; US-Patent-Appl-SN-8650; US-Patent-Class-214-90R) Avail: US Patent Office CSCL 13C

The design and development of crane with a mechanically extended telescoping boom are discussed. The boom assembly is caused to extend and retract through the action of several flexible tapes. A feature of the invention is a furlable tape adapted to be flattened and wound on a tape take-up drum as the boom assembly is retracted. During boom extension, the flexible tape forms an elongated tubular conduit extending between opposite ends of the boom assembly and permits hydraulic adjustment of the boom length. P.N.F.

N72-25022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COST STUDY OF SOLAR CELL SPACE POWER SYSTEMS
Daniel T. Bernatowicz 1972 4 p Presented at 9th Photovoltaic Specialists Conf., Silver Spring, Md., 2-4 May 1972; sponsored by IEEE
(NASA-TM-X-68054; E-6904) Avail: NTIS HC $3.00 CSCL 10A

Historical costs for solar cell space power systems were evaluated. The study covered thirteen missions that represented a broad cross section of flight projects over the past decade. Fully burdened costs in terms of 1971 dollars are presented for the system and the solar array. The costs correlate reasonably well with array area and do not increase in proportion to array area. The trends for array costs support the contention that solar cell and module standardization reduce costs. Author

N72-25023*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RELATIONSHIP OF DISLOCATION DENSITY OF SILICON TO SOLAR CELL CURRENT LOSS AT LOW TEMPERATURE
Joseph Mandelkorn, Cosmo R. Baraona, and John H. Lamneck, Jr. 1972 6 p refs Presented at 9th Photovoltaic Specialists Conf., Silver Spring, Md., 2-5 May 1972; sponsored by IEEE
(NASA-TM-X-68055; E-6905) Avail: NTIS HC $3.00 CSCL 10A

Large decreases in short circuit current of silicon solar cells have been reported to occur as temperature is decreased below -60 C. Experimental results are presented which relate high dislocation density of the silicon bulk material of cells to the large current loss effect. Solar cells were made by the same processes from a variety of silicon materials, namely low-dislocation-density, high-dislocation-density float-zone, and Czochralski silicon. All cells were etched in a manner which revealed the dislocation density of the cell bulk silicon. It was found that every cell made from any of the various low-dislocation starting materials obtained from three suppliers still had a low-dislocation bulk after cell processing, and that all such cells belonged to category good. Cells made from float-zone materials showed high dislocation densities in their bulk and either fell into category poor, or had intermediate losses of short-circuit current at low temperature. Author

N72-25024*# AiResearch Mfg. Co., Los Angeles, Calif.
PRELIMINARY DESIGN OF AN AUXILIARY POWER UNIT FOR THE SPACE SHUTTLE. VOLUME 2: COMPONENT AND SYSTEM CONFIGURATION SCREENING ANALYSIS
W. L. Burriss and M. L. Hamilton Washington NASA May 1972 229 p
(Contract NAS3-14408)
(NASA-CR-1994; Rept-71-7300-2-Vol-2) Avail: NTIS HC $3.00 CSCL 22B

The auxiliary power unit (APU) for the space shuttle is required to provide hydraulic and electrical power on board the booster and orbiter vehicles. Five systems and their associated components, which utilize hot gas turbines to supply horsepower at gearbox output pads, were studied. Hydrogen-oxygen and storable propellants were considered for the hot gas supply. All APU's were required to be self-contained with respect to dissipating internally generated heat. These five systems were evaluated relative to a consistent criteria. The system supplied with high pressure gaseous hydrogen and oxygen was recommended as the best approach. It included a two-stage pressure-compounded partial-admission turbine, a propellant conditioning system with recuperation, a control system, and a gearbox. The gearbox output used was 240 HP. At the close of the study a 400 HP level was considered more appropriate for meeting the prime shuttle vehicle needs, and an in-depth analysis of the system at the 400 HP output level was recommended. Author

N72-25025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODIFICATION OF A FUEL-CELL ENGINE FOR CONTROL BY A DIGITAL COMPUTER
Norman H. Hagedorn Washington Jun. 1972 10 p
(NASA-TM-X-2575; E-6866) Avail: NTIS HC $3.00 CSCL 10A

A manually operated fuel-cell system was modified to be monitored and controlled by a digital computer. The purpose was to have a test item with which to study possible system-computer interface problems. The modification consisted of installing solenoid valves, circuitry, transducers, and limit switches on the system. These modifications permit computer control of load current, reactant purge, water removal, and electrolyte concentration and computer initiation of system shutdown. Author

N72-25026*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND TESTING OF A HIGH CYCLE LIFE 30 A-H SEALED AgO-Zn BATTERY
R. S. Bogner 1 May 1972 42 p refs Portions of data prepared by ESB, Inc., and Naval Ammunition Depot, Crane, Ind.
(Contract NAS7-100)
(NASA-CR-126969; JPL-TM-33-536) Avail: NTIS HC $4.25 CSCL 10C

A two-phase program was initiated to investigate design parameters and technology to develop an improved AgO-Zn battery. The basic performance goal was 100 charge/discharge cycles (22 h/2 h) at 50 percent depth of discharge following a six-month period of charged stand at room temperature. Phase 1, cell evaluation, involved testing 70 cells in five-cell groups. The major design variables were active material ratios, electrolyte concentrations, separator systems, and negative plate shape. Phase 1 testing showed that cycle life could be improved 10 percent to 20 percent by using greater ratios of zinc to silver oxide and higher electrolyte concentrations. Wedge-shaped negatives increased cycle life by nearly 100 percent. Phase 2 battery evaluation, which was initiated before the Phase 1 results were known completely, involved evaluation of six designs as 19-cell batteries. Only one battery exceeded 100 cycles following nine months charged stand. Author

N72-25027# National Research Council of Canada, Ottawa (Ontario).
NEW THERMOPILES WITH LARGER RECEIVER AREA
V. E. Kartashevskaya and L. F. Litvinova 1972 13 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Issled. Inst. Metrol.

(Leningrad), v. 11-4, no. 174, 1970 p 116-123
(NRC-TT-1550) Avail: NTIS HC $3.00

The design and development of thermopiles with larger receiver area are discussed. The operation of the thermopiles is based on being a non-selective receiver of radiant light. The thermopiles provide a solution to the problem met with in heterochromatic photometry involving the selection of a correcting absorber which reproduces the relative luminosity. The thermopile also provides a better agreement between light and energy measurements, and a basis for the reproduction of light units with the help of energy measurements of the irradiation power by means of absolute receivers. Author

N72-25028# General Electric Co., Schenectady, N.Y.
MERCURIC OXIDE-CADMIUM BATTERY FOR TRANSCEIVER APPLICATIONS Technical Report, 1 Jul. 1969 - 30 Oct. 1971
H. A. Christopher, R. N. King, P. J. Moran, E. L. Fontanella, and D. E. Faires Jan. 1972 201 p refs
(Contract F33615-69-C-1831; AF Proj. 3145)
(AD-736769; S-71-1130; AFAPL-TR-71-99) Avail: NTIS CSCL 10/3

The work covered in this report was directed toward the design and fabrication of 200 prototype mercuric oxide-cadmium batteries to provide enhanced shelf life and low-temperature operating capability over the mercuric oxide-zinc system presently employed in the URC-64 transceiver radio. Emphasis in the design of this battery was aimed at a room-temperature energy density of 1.95 watthours per cubic inch and 19.2 watthours per pound. The specified load profile to be met over the entire spectrum of possible operating temperatures from -55 C to -74 C consisted of a 102-milliampere drain for one half-hour. The experimental program included efforts on the development of improved electrode structures and separator-electrolyte systems, the identification of suitable cell case materials and methods for cell assembly, the development of an optimized overall cell design, and corresponding techniques for producing the cell components required to meet the performance goals. A novel approach based on the use of a spiral electrode assembly in such button cells was developed to provide the needed electrode active area for low temperature performance in the minimum button cell volume allowance. Evaluation tests on finished batteries and individual button cells were performed. GRA

N72-25767*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATICALLY ACTIVATED, 300 AMPERE-HOUR SILVER-ZINC CELL
Thomas J. Hennigan *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 52-55 ref (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 10C

N72-25768*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCREENING AND SELECTION OF NICKEL AND CADMIUM CELL PLATES TO IMPROVE UNIFORMITY
Gerald Halpert *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 56-58 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 10C

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-25029*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
THE DEVELOPMENT OF SPECTRO-SIGNATURE INDICATORS OF ROOT DISEASE Annual Progress Report
John F. Wear 30 Sep. 1968 33 p refs
(NASA Order W-12996)
(NASA-CR-126719) Avail: NTIS HC $3.75 CSCL 02F

The development and testing of airborne sensors that might be effective in discriminating root rot of infected trees from healthy ones are outlined. The sensing device is composed of a thermal infrared radiometer and an instant replay video scan system. Author

N72-25030*# Techtran Corp., Glen Burnie, Md.
LUNG VENTILATION AND GAS EXCHANGE OF A MAN BREATHING DIFFERENT GAS MIXTURES WHILE SWIMMING UNDER WATER
V. I. Kebkalo and V. P. Ponomarev Washington NASA May 1972 13 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 57, no. 12, Dec. 1971 p 1802-1807
(Contract NASw-2037)
(NASA-TT-F-14260) Avail: NTIS HC $3.00 CSCL 06S

Eight healthy men, 19 to 26 years of age, were trained in aqualung swimming, from a distance of 500 meters at maximum speed and at a depth of about 2 meters. For breathing they used air and normoxic mixtures of argon and helium. The respiratory minute volume, oxygen consumption and carbon dioxide discharge increased when shifting to breathing of a less dense mixture. At the peak work load, the resistance to breathing increased in direct relation to the density of the mixture. The respiratory minute volume increased, in inverse proportion to the mixture density. The consumption of oxygen and the discharge of carbon dioxide while breathing air and the argon-oxygen mixture were practically the same, and during breathing of the helium-oxygen mixture they increased significantly. Author

N72-25031# Advisory Group for Aerospace Research and Development, Paris (France).
THE DISORIENTATION INCIDENT, PART 1
A. J. Benson, ed. (Royal Air Force Inst. of Aviation Med.) Mar. 1972 134 p refs Presented at Aerospace Med. Panel Specialist Meeting, Luchon, France, 28 Sep. 1971
(AGARD-CP-95-Pt-1) Avail: NTIS HC $8.75

The proceedings of a conference on spatial disorientation are presented. The subjects discussed are: (1) description and analysis of disorientation incidents, (2) orientation error accidents, (3) training procedures, and (4) laboratory studies. The presentations were given in 16 reports. The principal findings and recommendations are summarized in a technical evaluation report. For individual titles, see N72-25032 through N72-25047.

N72-25032*# San Jose State Coll., Calif.
DISORIENTATION INCIDENTS REPORT BY MILITARY PILOTS ACROSS 14 YEARS OF FLIGHT
Brant Clark *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 7 p refs (See N72-25031 16-04)
(Grant NGL-05-046-002)
(NASA-CR-126786) Avail: NTIS HC $3.00 CSCL 06S

The historical background of spatial disorientation problems among flying personnel is discussed. Recent incidents involving disorientation in flight were compared with incidents reported 14 years earlier. The incidents were very similar for various types of aircraft. The findings suggest that disorientation is currently experienced in a wide variety of flight operations and will continue to be experienced by flying personnel as an uncorrectable flight hazard. Author

N72-25033# Royal Air Force, Farnborough (England).
A REVIEW OF UNITED KINGDOM (RAF AND ARMY) STATISTICS ON SPATIAL DISORIENTATION IN FLIGHT 1960 - 1970
R. G. Lofting *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 5 p (See N72-25031 16-04)
Avail: NTIS HC $8.75

An analysis of spatial disorientation incidents among pilots of the Royal Air Force is presented. Subjects discussed are: (1) disorientation statistics, (2) aircraft types involved in disorientation occurrences, (3) classification of disorientation accidents, (4) classification of disorientation occurrences, and (5) relevant aircraft design features leading to disorientation. Author

N72-25034# Naval Aerospace Medical Research Lab., Pensacola, Fla.

ORIENTATION ERROR ACCIDENTS IN ARMY AVIATION AIRCRAFT

W. Carroll Hixson, Jorma I. Niven, and Emil Spezia (Army Board for Aviation Accident Res.) *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 16 p refs (See N72-25031 16-04)

Avail: NTIS HC $8.75

To initiate the action necessary to establish the magnitude of the orientation-error problem in Army aviation, an interservice research program was organized under the joint sponsorship of the U. S. Army Aeromedical Research Laboratory, the U. S. Army Board for Aviation Accident Research, and the Naval Aerospace Medical Research Laboratory. The first step was the construction of an operational definition of an orientation-error accident. The assimilation of data pertaining to the incidence and cause of such accidents and their actual and relative costs in terms of fatalities, injuries, and aircraft damage was then set as the working objective of the program. Accordingly, the decision was made to implement a five-year longitudinal study of all major and minor orientation-error accidents involving Army aviation flight operations beginning with July 1966. Incidence and cost data are presented for all Army aviation major and minor orientation-error accidents detected in the search of the accident files for the period July 1966 to July 1967. Separate and totalized statistical data are provided for fixed wing and rotary wing aircraft as well as for accidents occurring in Vietnam and those occurring elsewhere. Author

N72-25035# Bureau of Medicine and Surgery, Washington, D.C.

DISORIENTATION, FACT AND FANCY

Paul E. Tyler and Paul A. Furr *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 6 p refs (See N72-25031 16-04)

Avail: NTIS HC $8.75

The experiences of 2,000 naval aviators with disorientation during various flight conditions are presented. An analysis of all naval flight accidents for calendar year 1969 in which a disorientation incident contributed to the accident was made. It is shown that the majority of accidents coded as related to disorientation were erroneously coded. It was concluded that approximately 96 percent of aviators experience disorientation at some time, but that this disorientation contributes to a very small percentage of the accidents. Author

N72-25036# Naval Air Station, Norfolk, Va. Safety Center.

PSYCHOPHYSIOLOGICAL AND ENVIRONMENTAL FACTORS AFFECTING DISORIENTATIONS IN NAVAL AIRCRAFT ACCIDENTS

Earl H. Ninow, William F. Cunningham, and Frederick A. Radcliffe *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 4 p refs (See N72-25031 16-04)

Avail: NTIS HC $8.75

Psychophysiological and environmental factors, 12 in number, which most affect disorientation related mishaps are presented. These factors are listed in order of number of occurrence and it is indicated that often multiple factors are coded in conjunction with disorientation. Examples of disorientation related mishaps are presented to demonstrate psychophysiological and environmental factor involvement. A graph comparing attack and fighter pilot flight exposure to disorientation mishaps is charted to demonstrate the effect of experience upon control of disorientation. The chart indicates that flight experience does play a role in deterring of disorientation mishaps. Author

N72-25037# Naval Air Development Center, Johnsville, Pa. Crew Systems Dept.

DISORIENTING EFFECTS OF AIRCRAFT CATAPULT LAUNCHINGS

Malcolm M. Cohen, Richard J. Crosbie, and Laurence H. Blackburn *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 6 p refs (See N72-25031 16-04)

Avail: NTIS HC $8.75

A human centrifuge facility was used to simulate the acceleration profiles encountered in aircraft catapult launchings. Twelve subjects attempted to keep a continuously moving target at subjective eye level before, during, and after exposure to simulated catapult launch accelerations. Results demonstrated that subjective eye level was changed by exposure to the accelerative forces. The change in subjective eye level persisted, in some cases, for as long as three minutes after the simulated launch sequence was completed. The results are discussed in terms of the effects of rotated acceleration vectors on human spatial orientation, and the data are related to certain types of aircraft losses that have been reported following catapult launchings at night. Author

N72-25038# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

EFFECTS OF ACOUSTIC STIMULI ON THE VESTIBULAR SYSTEM

C. Stanley Harris *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 11 p refs (See N72-25031 16-04)

(AMRL-TR-71-58) Avail: NTIS HC $8.75

The effects of noise intensity on the human vestibular system with resultant disorientation, nausea, and dizziness are discussed. The response of human subjects to acoustic stimuli was measured using nystagmorgraphy, vertical perception, and a rail test of human equilibrium. Decrements in performance of 20 to 35 percent were obtained in high intensity noise of 140 decibels even when subjects wore ear protectors. Sound levels as low as 100 decibels were found to produce an adverse effect on task performance. It was also determined that noise levels affect human equilibrium at levels below those which will damage hearing. Author

N72-25039# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

ALCOHOL INDUCED POSTROTATORY FIXATIONAL NYSTAGMUS, A TRAINING FILM ON A SIMPLE METHOD OF DETECTING SLIGHT ALCOHOLIC INTOXICATIONS IN PILOTS

G. Froehlich *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 3 p refs (See N72-25031 16-04)

Avail: NTIS HC $8.75

A method for detecting moderate alcoholic intoxication in human subjects is presented. The method is based on observation of inability of intoxicated subject to suppress postrotatory fixational nystagmus. The subject, in a standing position, is turned around his vertical axis five times within ten seconds with his eyes open in a normally illuminated room. When the subject is stopped and asked to fix his vision on the examiner's finger held about 25 centimeters in front of his eyes, the intoxicated subject will be unable to fixate. The method involved was demonstrated by a motion picture. Author

N72-25040# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

ANALYSIS OF THE VESTIBULO-OCULAR COUNTERROLL REFLEX IN PRIMATES

A. M. Junker, C. R. Replogle, K. A. Smiles, R. D. Brown, and R. H. Wheeler (AF Inst. of Technol.) *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 10 p refs (See N72-25031 16-04)

(AMRL-TR-71-59) Avail: NTIS HC $8.75

The vestibulo-ocular reflex manifest by counterroll was used to determine the response dynamics of the vestibular system and alterations in these dynamics subsequent to +Gx acceleration

exposure. Six rhesus monkeys were tested before and after acceleration exposure to determine if significant changes had occurred in the vestibulo-ocular counterroll reflex. The tests consisted of constant speed rotation, pendular oscillations and multiple sine wave oscillations about the subject's cyclopean axis. Ocular counterroll was recorded using a linear resolver mechanically fixed to the monkey's eyeball. There is no significant decrease in the system gain with inputs up to 1 Hz. The observed phase lag can be accounted for by a time delay of approximately 0.2 seconds, and there is no significant response alteration caused by acceleration loading up to 75 +Gx. Author

N72-25041# Advisory Group for Aerospace Research and Development, Paris (France).
TWO SPECIFIC KINDS OF DISORIENTATION INCIDENTS: JET UPSET AND GIANT HAND
R. Malcolm and K. E. Money *In its* The Disorientation Incident, Part 1 Mar. 1972 4 p refs (See N72-25031 16-04)
Avail: NTIS HC $8.75

In certain circumstances (instrument flying conditions and severe turbulence), an inappropriate pilot input to aircraft controls leads to a dangerous nose down attitude of the aircraft. There have been something in excess of 26 of these jet upsets. In similar circumstances, there have been a few reports of what can be called the Giant Hand phenomenon, in which the pilot reports that the aircraft controls are forced into an extreme position and held there as if by a giant hand. Precipitating circumstances and underlying mechanisms of these two kinds of incidents are discussed, and some unpublished experimental observations are presented. Author

N72-25042# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).
SPATIAL DISORIENTATION AND THE BREAK-OFF PHENOMENA
A. J. Benson *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 11 p refs (See N72-25031 16-04)
Avail: NTIS HC $8.75

Reports of aircraft pilots concerning occurrence of disorientation with subsequent feelings of unreality and detachment are analyzed. It was determined that the reactions occurred during monotonous phases of flight in conditions where external visual orientation cues were restricted. Evidence is presented which suggests the spatial disorientation occurring as a concomitant of break-off was caused by minor degrees of vestibular asymmetry. The high incidence of anxiety reactions supports the view that in susceptible individuals break-off can be both a precipitant and a manifestation of anxiety neurosis.
Author

N72-25043# Naval Submarine Medical Center, Groton, Conn. Research Lab.
VERTIGO IN DIVERS
C. F. Gell *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 4 p refs (See N72-25031 16-04)
Avail: NTIS HC $8.75

The occurrence of vertigo in hyperbaric atmospheres and with underwater divers is discussed. Theories are presented to explain the etiology of these events. Some of the theories are: (1) barotrauma, (2) damage from the formation of bubbles, (3) hyperemia and hemorrhage, (4) unusual displacement of the stapes, (5) caloric stimulation, (6) slow movement of the ear drum and ossicles causing eddy currents, (7) performance of the valsalva maneuver, and (8) disturbed labrynthian function.
Author

N72-25044# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THEORY OF DEVELOPMENT OF REACTIONS TO WHOLE BODY MOTION CONSIDERED IN RELATION TO SELECTION, ASSIGNMENT, AND TRAINING OF FLIGHT PERSONNEL
Fred E. Guedry, Jr. *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 17 p refs (See N72-25031 16-04)
Avail: NTIS HC $8.75

A speculative theory, dealing with the development of reactions to whole-body motion, is outlined. Functional aspects of reactions at several stages of maturation are considered in relation to conditioning mechanisms which are, in turn, related to individual differences in development of motion reactivity, personality, and cognitive function. Unnatural feedback resulting from passive motion is discussed in relation to different control tasks performed in different job assignments and in relation to individual differences in reactions to motion. Adaptation to the unnatural whole-body movement of flight is considered in this context and in relation to experiments illustrating that substantial changes in reactions to motion can be accomplished through habituation. Aviator selection tests, personality tests, flight aptitude tests, and several categories of training are considered in relation to the theoretical constructs. Author

N72-25045# Civil Aeromedical Inst., Oklahoma City, Okla. Psychology Lab.
PRACTICAL TECHNIQUES FOR DISORIENTATION FAMILIARIZATION AND THE INFLUENCE OF VISUAL REFERENCE AND ALCOHOL ON DISORIENTATION-RELATED RESPONSES
William E. Collins *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 10 p refs (See N72-25031 16-04)
Avail: NTIS

Techniques and procedures for providing on-the-ground familiarization of aviation personnel with the effects of disorientation are discussed. The procedures are relatively inexpensive, effective for both participants and observers, and are readily accepted by aviators as pertinent to the aviation situation. The extent to which disorientation is affected by the type of visual information available to the pilot is examined under normal conditions and when alcohol is involved. Ways of demonstrating the deleterious effects of alcohol are described.
Author

N72-25046# Royal Air Force Central Medical Establishment, London (England).
THE DISORIENTATION ACCIDENT: PHILOSOPHY OF INSTRUMENT FLYING TRAINING
T. G. Dobie *In* AGARD The Disorientation Incident, Part 1 Mar. 1972 4 p refs (See N72-25031 16-04)
Avail: NTIS HC $8.75

Patterns of disorientation occurrences in the United Kingdom RAF and Army for the period 1960-1970 are examined in order to formulate possible explanations and recommendations concerning, in particular, the philosophy of instrument flight training. The aircraft types most commonly involved and the circumstances confirm the likelihood of sensory incongruity being a contributory factor in the majority of cases. The underlying differences between primary and secondary disorientation are discussed. The predominant emphasis both in aeromedical indoctrination and instrument flying practice is concerned with preventing primary spatial disorientation, but insufficient effort is made towards ensuring that primary disorientation when it occurs, does not develop into the dangerous secondary stage. The various methods of simulation of instrument flying are examined. Author

N72-25047# Advisory Group for Aerospace Research and Development, Paris (France).
CLINICAL EVALUATION AND TREATMENT OF DISORIENTATION IN AIRCREW
P. J. OConnor *In its* The Disorientation Incident, Part 1 Mar. 1972 6 p (See N72-25031 16-04)
Avail: NTIS HC $8.75

The clinical evaluation and medical treatment of disorientation problems in flying personnel are discussed. It was determined that disorientation occurs most frequently in ages between 30 and 50. The symptoms were divided into: (1) increased sensory

input, (2) decreased sensory input, and (3) disturbed central thought processes. Treatment was by explanation and reassurance with the addition of rehabilitation flying and treatment of associated psychiatric disorders. Of the 90 cases treated, 54 returned to full flying duty. Author

N72-25048# Advisory Group for Aerospace Research and Development, Paris (France).
IMPROVED AND SIMPLIFIED METHODS FOR THE CLINICAL EVALUATION OF AIRCREW, PART 2
Heinz S. Fuchs, ed. (AF Hospital Inspection System, West Germany) Mar. 1972 81 p refs Mostly in ENGLISH; partly in FRENCH Presented at the Aerospace Med. Panel Specialist Meeting, Luchon, France, 29-30 Sep. 1971
(AGARD-CP-95-Pt-2) Avail: NTIS HC $6.25

Practical aeromedical requirements are discussed in the areas of cardiorespiratory assessment, anthropometric methods, biochemical analyses, X-ray examinations, and special visual investigation methods. For individual titles, see N72-25049 through N72-25060.

N72-25049# Beach Army Hospital, Fort Wolters, Tex.
MEDICAL ELIMINATION OF STUDENTS UNDERGOING PRIMARY FLIGHT TRAINING
Guthrie L. Turner, Jr. and Eric E. Lindstrom *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 5 p refs (See N72-25048 16-04)
Avail: NTIS HC $6.25

A group of 5,278 student aviators were processed for primary helicopter training. All had undergone the initial Class 1 or 1A flight physical examination for flying and were found qualified. Students eliminated during calender year 1970 from all causes totaled 1,410. Of this number 168 were eliminated for medical causes. Eye defects; ear, nose and throat defects; and neuropsychiatric abnormalities accounted for 53.8% of the medical eliminations. Of the 168 student aviators eliminated, 87 had medical defects that were probably detectable on the initial flight physical. Author

N72-25050# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
WHAT IS THE MEANING OF THE MASTER-STEP-TEST IN EXAMINATIONS TO DETERMINE THE FITNESS FOR MILITARY FLYING DUTY
H. W. Kirchhoff and A. Dietz *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 3 p (See N72-25048 16-04)
Avail: NTIS HC $6.25

Long term examinations by means of an ECG were conducted on approximately 1000 pilots between 18 and 50 years of age. For the period of the past 14 years, at least 8 ECG's were obtained for each pilot. The examinations revealed the following results: (1) Abnormal or conspicuous ECG alterations are found to a small extent in tests at rest and in master tests. (2) The number of conspicuous ECG findings increases with age. It became evident that special examinations, such as ergometer or hypoxia ECG, more frequently indicate abnormal ECG alterations than the routine procedures. Use of the master test is recommended only in routine examinations from the 35th year of age on. Author

N72-25051# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
USE OF LONGTERM ECG IN AVIATION MEDICINE
A. Dietz and H. W. Kirchhoff *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 6 p refs (See N72-25048 16-04)
Avail: NTIS HC $6.25

A one-channel portable tape recording system for long term ECG recording is described. The possibilities of application of such a system in the examination and assessment of flying personnel is considered. Topics discussed include: (1) supplementation of ECG diagnostics in examinations to determine fitness for military flying duty, (2) longitudinal observations for scientific clarification of certain ECG alterations, (3) inflight ECG examinations, and (4) heart rate registration during special examinations in aviation psychology, and training effects on heart rate. Author

N72-25052# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
THE AUTOMATIC ANALYSIS OF THE ECG AT REST, DURING AND AFTER EXERCISE WITH TWO DIFFERENT COMPUTER SYSTEMS
J. Zipfel, J. D. Meyer-Erkelenz, C. V. Kirschbaum, and H. W. Kirchhoff *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 5 p (See N72-25048 16-04)
Avail: NTIS HC $6.25

The quality of various lead systems and computer programs for ECG diagnosis is considered. For the evaluation of the standard leads, the Minnesota system can be used. The program of Arvedson was used for the Frank system, which is particularly suitable for computer. The ECG was recorded at rest and during exercise to detect the beginning of coronary artery disease. The quantified ergometer work load was used as exercise. Attention was directed towards the evaluation of ST-T changes. The results were compared with the diagnosis of a cardiology team for the two computers. It is concluded that at rest and in the postexercise period, the use of both computer systems is justified. Author

N72-25053# School of Aerospace Medicine, Brooks AFB, Tex.
EXTENDED ELECTROCARDIOGRAPHIC MONITORING WITH EMPHASIS ON COMPUTER ANALYSIS OF THE RECORDS
William H. Walter, III, Eric D. Grassman, Edward J. Engelken, and Malcolm C. Lancaster *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 5 p refs (See N72-25048 16-04)
Avail: NTIS HC $6.25

The use of continuous 6 to 8 hour tape-recorded electrocardiograms in the evaluation of patients with known or suspected cardiac disorders proved to be of value. All of the present commercially available equipment requires that a physician personally review each 6 to 8 hour tape. These tapes may be scanned at 36 to 60 times real time, and suspicious portions may be reproduced in equivalent real time. In an effort to accurately detect, count, and classify atypical ventricular depolarization complexes, an analog computer program was developed. Author

N72-25054# Royal Air Force Hospital, Wegberg (West Germany).
PROBLEMS IN THE CLINICAL ASSESSMENT OF RAISED ARTERIAL BLOOD PRESSURE IN AIRCREW
J. N. C. Cooke *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 3 p refs (See N72-25048 16-04)
Avail: NTIS HC $6.25

The further assessment of apparently raised blood pressure levels found on routine examination of aircrew members is considered. The initial problem is posed by difficulties in establishing definite limits of normalcy and in fixing any level of blood pressure that divides health from disease. In the Royal Air Force, a consultant physician makes an initial clinical assessment and decides if there is a requirement for detailed investigation. This investigation consists of a standardized comprehensive search for possible causes for a rise in blood pressure and for associated pathological conditions. After this investigation a number of subjects remain whose fitness for further flying must be judged upon their blood pressure alone. These figures are subject to great variability, compounded by known factors of anxiety, tension, observer error, and environmental influences. Some of these problems might be reduced by repeated recordings under standardized conditions and the use of automatic cuff

recorders in the hope that comparisons over varying time intervals may show up clear trends of improvement or deterioration in an individual. Final disposal still depends largely on the statistical evidence for increased mortality and morbidity associated with raised blood pressure levels and the resultant need to institute treatment. Author

N72-25055# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

A SIMPLIFIED AND IMPROVED METHOD FOR OPERATIONAL ANTHROPOMETRIC PROGRAMMES c05

H. J. Grunhofer *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 8 p (See N72-25048 16-04)

Avail: NTIS HC $6.25

The operational significance of antropometric data is demonstrated by an example of consequences following the introduction of an ejection seat in an aircraft. Several simplified measuring devices and techniques are discussed. A device for the application of anthropometric data and for medical re-evaluation of pilots with possible functional impairments is discussed. Author

N72-25056# Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).

RADIOLOGICAL EXAMINATION OF THE SPINE AND THE COMBAT PILOT'S CAPABILITY FOR DUTY [EXAMEN RADIOLOGIQUE DU RACHIS ET APTITUDE A L'EMPLOI DE PILOTE DE COMBAT]

R. P. Delahaye, G. Gueffier, and P. J. Metges *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 10 p refs In FRENCH (See N72-25048 16-04)

Avail: NTIS HC $6.25

The radiological examination of the spine during entrance fitness examinations of flying personnel is discussed. The limiting scoliotic angle for combat flight was determined to be 10 degrees, beyond which there is danger of injury in the case of ejection from the aircraft. Transl. by K.P.D.

N72-25057*# National Aeronautics and Space Administration, Washington, D.C.

A SIMPLIFIED SPACE TECHNOLOGY METHOD FOR CLINICAL AIRCREW MEASUREMENT OF FUNCTIONAL RESPIRATORY VALUES

Walton L. Jones and B. M. Bushman (Perkin-Elmer Corp., Pomona, Calif.) *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 11 p (See N72-25048 16-04)

(NASA-TM-X-68370) Avail: NTIS HC $3.00 CSCL 06E

A versatile, rapid, reliable respiratory gas analyzer based on mass spectrometer principles was developed for air crew pulmonary function measurement. The instrument can provide a continuous and simultaneous analysis of up to eight gases useful in pulmonary function evaluation. The principal gases include oxygen, carbon dioxide, nitrogen, and water vapor. The instrument is suited to air crew and space cabin applications because: (1) The quantity of gas diverted to the mass spectrometer is a negligible fraction of the expired gas. (2) The time response of the mass spectrometer is fast relative to the breath cycle time. (3) The mass spectrometer is capable of accurate partial pressure measurements. (4) The size, weight, and power requirements are compatible with most in-flight applications. (5) Simplicity and reliability of operation are stressed. Author

N72-25058# Royal Air Force, Farnborough (England). Central Medical Establishment.

IMPROVED METHODS OF CLINICAL ELECTRODIAGNOSIS IN PROGNOSIS OF LOWER MOTOR NEURONE LESIONS

C. B. Wynn-Parry *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 4 p refs (See N72-25048 16-04)

Avail: NTIS HC $6.25

Techniques in electromyography are discussed in connection with the diagnosis of lower motor neurons lesions. Various lesions and their symptoms are considered. K.P.D.

N72-25059# Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).

INTEREST IN MEASURING RESISTANCE TO VERTIGO AMONG FLYING PERSONNEL [INTERET DE LA MESURE DE LA RESISTANCE A L'EBLOUISSEMENT CHEZ LES MEMBRES DU PERSONNEL NAVIGANT]

J. P. Chevaleraud and G. Perdriel *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 3 p In FRENCH (See N72-25048 16-04)

Avail: NTIS HC $6.25

A simple method is presented which permits the evaluation of aptitude for regaining visual function while being subjected to vertigo. The orientation of the subject and authorization for revocation of flight activities when an ocular affection is involved are considered. Transl. by K.P.D.

N72-25060# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

ALCOHOL INDUCED POSTROTATORY FIXATIONAL NYSTAGMUS, A TRAINING FILM ON A SIMPLE METHOD OF DETECTING SLIGHT ALCOHOLIC INTOXICATIONS IN PILOTS

G. Froehlich *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 11 p refs (See N72-25048 16-04)

Avail: NTIS HC $6.25

A film showing the practical procedure and its nystagmographical correlates is discussed. With this test, the flight surgeon has at his disposal a reliable and simple method to detect and thus eliminate from duty flying pilots in an acute state of alcohol intoxication or with a marked hangover from the night before. Author

N72-25061*# IIT Research Inst., Chicago, Ill.

STUDY OF THE EFFECT OF SPACE CABIN ENVIRONMENT ON SUSCEPTIBILITY TO DISEASE Final Report, 27 Jun. 1967 - 31 Jan. 1972

24 Apr. 1972 96 p refs

(Contract NAS9-7180)

(NASA-CR-115641; IITRI-L6046-55) Avail: NTIS HC $7.00 CSCL 06S

Decreased resistance to infections initiated by respiratory challenge with Klebsiella pneumoniae or influenza virus was observed in mice maintained in a simulated space cabin environment represented by 98% oxygen atmosphere and 27,000 ft altitude (5 psi). The reduced resistance was manifested by increased mortality rates as compared to those seen in mice maintained at ground level condition. However, an adaptation to the stress appeared to be present in mice exposed to the space cabin environment for extended time period, i.e. 36 days, and then challenged with the influenza virus. Reduced resistance was not observed when Salmonella typhimurium was used as the challenge agent. Histopathologic examination of lungs of mice indicated that the severity of damage appeared to be related to the duration of exposure to the simulated space cabin environment. Author

N72-25062*# National Aeronautics and Space Administration, Washington, D.C.

ANIMAL ORIENTATION AND NAVIGATION

Sidney R. Galler, ed., Klaus Schmidt-Koenig, ed., George J. Jacobs, ed., and Richard E. Belleville, ed. 1972 586 p refs Proc. of a Symp. held at Wallops Station, Va., 9-13 Sep. 1970; Sponsored by NASA, the Smithsonian Institution, and the Am. Inst. of Biol. Sci.

(NASA-SP-262; LC-75-611767) Avail: NTIS; SOD $5.75 CSCL 09F

The proceedings of a conference on animal orientation and navigation are presented. The discussions were divided into two areas: the use of electronic equipment to study the migratory habits of birds and animals, and explanations of the behavioral characteristics of a variety of non-human creatures. The sessions considered the following topics: (1) radar and radio tracking of birds and animals, (2) bird migration and homing, (3) biological aspects of animal sensors for homing and navigation, and (4) possible applications of biological sensor knowledge to the solution of navigation problems. For individual titles, see N72-25063 through N72-25098.

N72-25063*# Smithsonian Institution, Washington, D.C.
USE OF THE DOPPLER TECHNIQUE TO TRACK FREE ROAMING ANIMALS FROM SATELLITES c07
James C. Maxwell *In* NASA, Washington Animal Orientation and Navigation 1972 p 7-17 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 09F

The application of the Doppler effect to track wild animals is discussed, with artificial satellites used to provide wide range coverage. The limitations of radiotelemetry for the purpose of tracking animals are presented. The advantages of the artificial satellite, with specific reference to the Nimbus satellite, are examined. P.N.F.

N72-25064*# Sensory Systems Lab., Tucson, Ariz.
LONG RANGE RADIO TRACKING OF SEA TURTLES AND POLAR BEAR: INSTRUMENTATION AND PRELIMINARY RESULTS c07
Howard A. Baldwin (Ariz. Univ., Tucson) *In* NASA, Washington Animal Orientation and Navigation 1972 p 19-37 refs (See N72-25062 16-04)
(Grant NGR-03-041-001; Contract Nonr-4315(00))
Avail: NTIS; SOD $5.75 CSCL 09F

Instrumentation developed for studies of path behavior of the green sea turtle and migration movement of polar bear is described. Preliminary results bearing on navigation ability in these species are presented. Both species operate in difficult environments, and the problems faced in the design of electronic instrumentation for these studies are not completely specified at this time. However, the critical factors yet to be understood are primarily related to the behavior of instrumented animals. The data obtained with these experimental techniques are included, first to illustrate the technique and, second to provide initial preliminary results bearing on animal navigation. Author

N72-25065*# Illinois Natural History Survey, Urbana.
LONG DISTANCE TRACKING OF BIRDS c07
William W. Cochran *In* NASA, Washington Animal Orientation and Navigation 1972 p 39-59 refs (See N72-25062 16-04)
(Grants NSF GB-3155; NSF GB-6680)
Avail: NTIS; SOD $5.75 CSCL 09F

The application of radio telemetry techniques to the long distance tracking of birds is discussed. The types of equipment developed and methods for attachment to a bird are described. The operating range of the radio transmitter receiver system is examined, and methods for acquiring and analyzing the data are explained. P.N.F.

N72-25066*# Catholic Univ. of America, Washington, D.C.
RECENT STATISTICAL METHODS FOR ORIENTATION DATA
Edward Batschelet *In* NASA, Washington Animal Orientation and Navigation 1972 p 61-91 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

The application of statistical methods for determining the areas of animal orientation and navigation are discussed. The method employed is limited to the two-dimensional case. Various tests for determining the validity of the statistical analysis are presented. Mathematical models are included to support the theoretical considerations and tables of data are developed to show the value of information obtained by statistical analysis. P.N.F.

N72-25067*# American Inst. of Biological Sciences, Washington, D.C.
STATE OF THE ART: A REVIEW
John H. Busser *In* NASA, Washington Animal Orientation and Navigation 1972 p 93-96 (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

Electronic devices and instruments currently used to track animals in order to determine their migratory and navigational behavior are discussed. Passive and active transducers in use for this purpose are described. The characteristics of the data received by the transducers and the equipment used to process the data are explained. P.N.F.

N72-25068*# Smithsonian Institution, Washington, D.C.
SATELLITE AND GROUND RADIOTRACKING OF ELK c07
Frank C. Craighead, Jr., John J. Craighead, Charles E. Cote, and Helmut K. Buechner *In* NASA, Washington Animal Orientation and Navigation 1972 p 99-111 refs (See N72-25062 16-04)
(Contract NASw-1983)
Avail: NTIS CSCL 09F

Radiotracking and monitoring of free-living animals in natural environments is providing an effective new technique for acquiring information on biological processes, including animal orientation and navigation. To test the practicability of extending the technique by using satellite systems for tracking animals, a female elk was instrumented with an electronic collar. It contained both the Interrogation Recording Location System (IRLS) transponder and a Craighead-Varney ground-tracking transmitter. The elk was successfully tracked and monitored by satellite during month of April 1970. This was the first time an animal had been tracked by satellite on the surface of the earth. Author

N72-25069*# State Univ. of New York at Buffalo.
TRACKING RADAR STUDIES OF BIRD MIGRATION c07
Timothy C. Williams, Janet M. Williams, John M. Teal (Woods Hole Oceanographic Institution), and John W. Kanwisher (Woods Hole Oceanographic Institution) *In* NASA, Washington Animal Orientation and Navigation 1972 p 115-128 refs (See N72-25062 16-04)
(Grants NSF GZ-259; NSF gb-13246)
Avail: NTIS; SOD $5.75 CSCL 17I

The application of tracking radar for determining the flight paths of migratory birds is discussed. The effects produced by various meteorological parameters are described. Samples of radar scope presentations obtained during tracking studies are presented. The characteristics of the radars and their limitations are examined. P.N.F.

N72-25070*# Clemson Univ., S.C.
FLIGHT DIRECTIONS OF PASSERINE MIGRANTS IN DAYLIGHT AND DARKNESS: A RADAR AND DIRECT VISUAL STUDY
Sidney A. Gauthreaux, Jr. *In* NASA, Washington Animal Orientation and Navigation 1972 p 129-137 refs (See N72-25062 16-04)
(Grant AF-AFOSR-1879-70)
Avail: NTIS; SOD $5.75 CSCL 06C

The application of radar and visual techniques to determine the migratory habits of passerine birds during daylight and darkness is discussed. The effects of wind on the direction of migration are examined. Scatter diagrams of daytime and nocturnal migration track directions correlated with wind direction are presented. It is concluded that migratory birds will fly at altitudes where wind direction and migratory direction are nearly the same. The effects of cloud cover and solar obscuration are considered negligible. P.N.F.

N72-25071*# Durham Univ. (England).
INFORMATION ON BIRD NAVIGATION OBTAINED BY BRITISH LONG RANGE RADARS c07

Peter R. Evans *In* NASA, Washington Animal Orientation and Navigation 1972 p 139-149 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 17I

Radar observations of the migratory habits of passerine birds over a 10 year period are presented. The relationships between intensity of cloud cover and the frequency and density of migration are illustrated. The aspects of migration which were determined by the radar were: (1) migration under total overcast, (2) compensation for wind drift, (3) changes in flight direction during migration, and (4) effects of meteorological parameters.
P.N.F.

N72-25072*# Basel Univ. (Switzerland).
METHODS OF QUANTITATIVE AND QUALITATIVE ANALYSIS OF BIRD MIGRATION WITH A TRACKING RADAR **c07**
Bruno Bruderer and Peter Steidinger (Zurich Univ.) *In* NASA, Washington Animal Orientation and Navigation 1972 p 151-167 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 17I

Methods of analyzing bird migration by using tracking radar are discussed. The procedure for assessing the rate of bird passage is described. Three topics are presented concerning the grouping of nocturnal migrants, the velocity of migratory flight, and identification of species by radar echoes. The height and volume of migration under different weather conditions are examined. The methods for studying the directions of migration and the correlation between winds and the height and direction of migrating birds are presented. Author

N72-25073*# Rockefeller Univ., New York.
NOCTURNAL BIRD MIGRATION IN OPAQUE CLOUDS
Donald R. Griffin *In* NASA, Washington Animal Orientation and Navigation 1972 p 169-188 refs (See N72-25062 16-04)
(Grant NSF GB-7155)
Avail: NTIS; SOD $5.75 CSCL 06C

The use of a tracking radar to measure the flight paths of migrating birds on nights with opaque clouds is discussed. The effects of wind and lack of visual references are examined. The limitations of the radar observations are described, and samples of tracks obtained during radar observations are included. It is concluded that nonvisual mechanisms of orientation make it possible for birds to migrate in opaque clouds, but the exact nature of the sensory information cannot be determined by radar observations. Author

N72-25074*# Cornell Univ., Ithaca, N.Y.
THE ONTOGENETIC DEVELOPMENT OF ORIENTATION CAPABILITIES
Stephen T. Emlen *In* NASA, Washington Animal Orientation and Navigation 1972 p 191-210 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

The effects of celestial references on the navigation ability of birds are discussed. Tests were conducted in a planetarium with indigo buntings to determine the amount of stellar pattern which could be removed before disorientation occurred. It was determined that young birds have a predisposition to respond to the apparent rotational motion of the night sky. It was concluded that the peak in responsiveness to rotational information is presented during the first summer of life, prior to the first migration season. Author

N72-25075*# Max-Planck-Institut fuer Verhaltensphysiologie, Seewiesen uber Starnberg (West Germany).
AN APPROACH TOWARD AN ANALYSIS OF THE PATTERN RECOGNITION INVOLVED IN THE STELLAR ORIENTATION OF BIRDS
Hans G. Wallraff *In* NASA, Washington Animal Orientation and Navigation 1972 p 211-222 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

A conditioning method was used to investigate the orientational responses of ducks as affected by manipulations of the stellar patterns in a planetarium. Under simulated natural skies it was possible to train a bird to a particular direction successively under all positions of the rotating sphere at a constant latitude. The responses were independent of the phase relationships between local time, season, and appearance of the sky provided the bird had been trained under the particular sector of the sphere some time before. Author

N72-25076*# Illinois Natural History Survey, Urbana.
POSSIBLE STEPS IN THE EVOLUTIONARY DEVELOPMENT OF BIRD NAVIGATION
Frank C. Bellrose *In* NASA, Washington Animal Orientation and Navigation 1972 p 223-257 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

Hypotheses are presented to explain the evolutionary development of navigational ability in migratory birds. Areas of discussion to describe the possible techniques are: (1) sun compass, (2) bicoordinate navigation, (3) star compass, (4) wind cues, (5) earth magnetic field, and (6) landscape features. It is concluded that landscape is the single most important cue for orientation of nonmigratory birds. The long range migratory birds appear to use a combination of cues with the relative importance of the cue dependent upon the species of the bird involved.
Author

N72-25077*# Swiss National Foundation for Scientific Research, Meikirch.
TOPOGRAPHY AND PIGEON ORIENTATION
Gerhart Wagner *In* NASA, Washington Animal Orientation and Navigation 1972 p 259-273 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

Two types of homing experiments with pigeons to determine the influence of topographical features on the orientation behavior of the birds are discussed. The releases and following were conducted by ground experiments in which the birds are tracked by visual observation at points of topographical interest and the helicopter method by which the birds are tracked throughout the entire flight. The ground experiments showed a strong influence of topographical features on initial orientation. The helicopter experiments showed that the ground experiments do not provide adequate information on the manner in which homing occurs. Author

N72-25078*# Gottingen Univ. (West Germany).
NEW EXPERIMENTS ON THE EFFECT OF CLOCK SHIFTS ON HOMING IN PIGEONS
Klaus Schmidt-Koenig (Duke Univ.) *In* NASA, Washington Animal Orientation and Navigation 1972 p 275-282 refs (See N72-25062 16-04)
(Grants NGR-34-001-019; NSF GB-2952)
Avail: NTIS; SOD $5.75 CSCL 06C

The effect of clock shifts as an experimental tool for predictably interfering with the homing ability of birds is discussed. Clock shifts introduce specific errors in the birds' sun azimuth compass, resulting in corresponding errors during initial orientation and possibly during orientation enroute. The effects of 6 hour and 12 hour clock shifts resulted in a 90 degree deviation and a 180 degree deviation from the initial orientation, respectively. The method for conducting the clock shift experiments and results obtained from previous experiments are described.
Author

N72-25079*# State Univ. of New York, Stony Brook.
THE NAVIGATION OF HOMING PIGEONS: DO THEY USE SUN NAVIGATION?
Charles Walcott *In* NASA, Washington Animal Orientation and Navigation 1972 p 283-292 refs (See N72-25062 16-04)
(Grant NSF GB-6777)
Avail: NTIS; SOD $5.75 CSCL 06C

Experiments to determine the dependence of homing pigeons on the sun as a navigational cue are discussed. Various methods

were employed to interrupt the circadian rhythms of the pigeons prior to release. It was determined that the sun may serve as a compass, but that topographic features are more important for navigation. The effects of a magnetic field produced by electric equipment carried by the bird were also investigated. It was concluded that magnetic fields may have a small effect on the homing ability. The exact nature of the homing pigeon's navigational ability is still unknown after years of elaborate experimentation. Author

N72-25080*# Duke Univ., Durham, N.C.
SOME ASPECTS OF THE USE OF VISUAL CUES IN DIRECTIONAL TRAINING OF HOMING PIGEONS
Dennis L. McDonald *In* NASA, Washington Animal Orientation and Navigation 1972 p 293-304 refs (See N72-25062 16-04)
(Grants NGR-34-001-019; Contract Nonr-1181; Grants MH-04453; HD-02319)
Avail: NTIS; SOD $5.75 CSCL 06C

An investigation, aimed at determining how accurately homing pigeons can measure the position of a light source and what cues are used in making these measurements, is presented. Author

N72-25081*# Harvard Univ., Cambridge, Mass.
BIOLOGY CAN USE TRAINED ANIMALS
Richard J. Herrnstein *In* NASA, Washington Animal Orientation and Navigation 1972 p 305-319 refs Sponsored by NASA and Natl. Inst. of Mental Health (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

The use of trained animals to solve complicated biological problems related to psychology is discussed. Data cover sensory and motor capacity. Several examples and experiments are described. E.H.W.

N72-25082*# Max Planck-Institut fuer Verhaltensphysiologie, Seewiesen uber Starnberg (West Germany).
ENDOGENOUS TIMING FACTORS IN BIRD MIGRATION
Eberhard G. Gwinner *In* NASA, Washington Animal Orientation and Navigation 1972 p 321-338 refs (See N72-25062 16-04)
(Grant NSF GB-5969X)
Avail: NTIS; SOD $5.75 CSCL 06C

Several species of warbler birds were observed in an effort to determine what initiates and terminates migration. Environmental and endogenous timing mechanisms were analyzed. The results indicate that endogenous stimuli are dominant factors for bird migration especially for long distances. It was concluded that environmental factors act as an assist mechanism. E.H.W.

N72-25083*# Washington Univ., St. Louis, Mo.
NEUROPHYSIOLOGICAL ANALYSIS OF ECHOLOCATION IN BATS
Nobuo Suga *In* NASA, Washington Animal Orientation and Navigation 1972 p 341-353 refs (See N72-25062 16-04)
(Grants NSF GB-13904; FR-504; FR-07054)
Avail: NTIS; SOD $5.75 CSCL 06C

An analysis of echolocation and signal processing in brown bats is presented. Data cover echo detection, echo ranging, echolocalization, and echo analysis. Efforts were also made to identify the part of the brain that carries out the most essential processing function for echolocation. Results indicate the inferior colliculus and the auditory nuclei function together to process this information. E.H.W.

N72-25084*# Yale Univ., New Haven, Conn.
MIDDLE EAR MUSCLE CONTRACTIONS AND THEIR RELATION TO PULSE AND ECHO EVOKED POTENTIALS IN THE BAT
O. W. Henson, Jr. and Miriam M. Henson *In* NASA, Washington Animal Orientation and Navigation 1972 p 355-363 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

An analysis is made of pulse and echo orientation cries of the Mustache Bat. That bat's cries are characterized by a long, 60 to 30 msec, pure tone component and brief beginning and terminal FM sweeps. In addition to obvious echo overlap and middle ear muscle contractions, the following are examined: (1) characteristics of pulse- and echo-evoked potential under various conditions, (2) evidence of changes in hearing sensitivity during and after pulse emission, and (3) the role of the middle ear muscles in bringing about these changes. E.H.W.

N72-25085*# Johns Hopkins Univ., Baltimore, Md.
INDIVIDUAL RECOGNITION BETWEEN MOTHER AND INFANT BATS (MYOTIS)
Dennis Turner, Anna Shaughnessy, and Edwin Gould *In* NASA, Washington Animal Orientation and Navigation 1972 p 365-371 refs (See N72-25062 16-04)
(Grants NBO-7229-02; FR-5445-09)
Avail: NTIS; SOD $5.75 CSCL 06C

The recognition process and the basis for that recognition, in brown bats, between mother and infant are analyzed. Two parameters, ultrasonic communication and olfactory stimuli, are investigated. The test animals were not allowed any visual contact. It was concluded that individual recognition between mother and infant occurred. However, it could not be determined if the recognition was based on ultrasonic signals or olfactory stimuli. E.H.W.

N72-25086*# California Univ., San Diego.
NEUROPHYSIOLOGICAL FINDINGS RELEVANT TO ECHOLOCATION IN MARINE ANIMALS
Theodore H. Bullock and Sam H. Ridgway (Naval Undersea Res. and Develop. Center) *In* NASA, Washington Animal Orientation and Navigation 1972 p 373-395 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

A review of echolocation mechanisms in marine mammals, chiefly porpoises, is given. Data cover peripheral auditory and central neurophysiological specializations favorable to the analysis of echolocating clicks and their echoes. Conclusions show (1) signals are received from 50 up to at least 135 kHz, (2) sound is received through the mandible skin, and (3) the midbrain sites are insensitive to low frequencies (below 6 kHz). E.H.W.

N72-25087*# Oceanic Inst., Waimanalo, Hawaii.
A THEORY FOR THE FUNCTION OF THE SPERMACETI ORGAN OF THE SPERM WHALE (PHYSETER CATODON L.)
Kenneth S. Norris (Calif. Univ., Los Angeles) and George W. Harvey *In* NASA, Washington Animal Orientation and Navigation 1972 p 397-417 refs (See N72-25062 16-04)
(Grant NS-05427-07CMS)
(Contrib-74) Avail: NTIS; SOD $5.75 CSCL 06C

The function of the spermaceti organ of the sperm whale is studied using a model of its acoustic system. Suggested functions of the system include: (1) action as an acoustic resonating and sound focussing chamber to form and process burst-pulsed clicks; (2) use of nasal passages in forehead for repeated recycling of air for phonation during dives and to provide mirrors for sound reflection and signal processing; and (3) use of the entire system to allow sound signal production especially useful for long range echolocofion in the deep sea. E.H.W.

N72-25088*# Zurich Univ. (Switzerland).
VISUAL ORIENTATION PERFORMANCES OF DESERT ANTS (CATAGLYPHIS BICOLOR) TOWARD ASTROMENOTACTIC DIRECTIONS AND HORIZON LANDMARKS
Rudiger Wehner *In* NASA, Washington Animal Orientation Navigation 1972 p 421-436 refs (See N72-25062 16-04)

Avail: NTIS; SOD $5.75 CSCL 06C

Experimental data, on the visual orientation of desert ants toward astromenotactic courses and horizon landmarks involving the cooperation of different direction finding systems, are given. Attempts were made to: (1) determine if the ants choose a compromise direction between astromenotactic angles and the direction toward horizon landmarks when both angles compete with each other or whether they decide alternatively; (2) analyze adaptations of the visual system to the special demands of direction finding by astromenotactic orientation or pattern recognition; and (3) determine parameters of visual learning behavior. Results show separate orientation mechanisms are responsible for the orientation of the ant toward astromenotactic angles and horizon landmarks. If both systems compete with each other, the ants switch over from one system to the other and do not perform a compromise direction. E.H.W.

N72-25089*# Yale Univ., New Haven, Conn.

VISUAL DIRECTION FINDING BY FISHES

Talbot H. Waterman *In* NASA, Washington Animal Orientation and Navigation 1972 p 437-456 refs (See N72-25062 16-04)

Avail: NTIS; SOD $5.75 CSCL 06C

The use of visual orientation, in the absence of landmarks, for underwater direction finding exercises by fishes is reviewed. Celestial directional clues observed directly near the water surface or indirectly at an asymptatic depth are suggested as possible orientation aids. E.H.W.

N72-25090*# Texas A&M Univ., College Station.

ORIENTATION THROUGH CHEMO RECEPTION IN FISHES

Herman Kleerekoper *In* NASA, Washington Animal Orientation and Navigation 1972 p 459-468 refs (See N72-25062 16-04)

Avail: NTIS; SOD $5.75 CSCL 06C

A system designed to acquire and process data describing locomotor behavior of fish is described. Data are recorded in relation to the fish's response to olfactory stimuli. It was concluded that fish orientation is based on rheataxis or chemotropotaxis. E.H.W.

N72-25091*# Florida Univ., Gainesville.

THE CASE FOR LONG RANGE CHEMORECEPTIVE PILOTING IN CHELONIA

Archie F. Carr, Jr. *In* NASA, Washington Animal Orientation and Navigation 1972 p 469-483 refs (See N72-25062 16-04)

Avail: NTIS; SOD $5.75 CSCL 06C

The reproductive ecology and migration habits of Chelonia are investigated. Efforts were made to determine if the turtle navigates by chemoreception and if sensory responses of the migrating animals could be electronically tracked through telemetry. Efforts were also made to: (1) explain why certain small islands or restricted areas of mainland shore are chosen by Chelonia as nesting grounds, even when located a thousand miles or more from the year round feeding grounds of the population; (2) identify guidance mechanisms used by migrants in their periodic open ocean travels; and (3) account for the so called lost year - the virtually complete disappearance of young sea turtles during their first year of life. It was suggested that turtle migration is aided by an olfactory mechanism, sun compass, and ocean currents. The tracking experiment was unsuccessful; the equipment was lost or damaged and stopped functioning after about two hours. E.H.W.

N72-25092*# Wisconsin Univ., Madison.

HOMING ORIENTATION IN SALAMANDERS: A MECHANISM INVOLVING CHEMICAL CUES

Dale M. Madison *In* NASA, Washington Animal Orientation and Navigation 1972 p 485-498 refs (See N72-25062 16-04)

(Contract AT(30-1)-3554; Grants NSF GB-2496; GM-44846)

Avail: NTIS; SOD $5.75 CSCL 06C

A detailed description is given of experiments made to determine the senses and chemical cues used by salamanders for homing orientation. Sensory impairment and cue manipulative techniques were used in the investigation. All experiments were carried out at night. Results show that sense impaired animals did not home as readily as those who were blind but retained their sensory mechanism. This fact suggests that the olfactory mechanism is necessary for homing in the salamander. It was determined that after the impaired salamander regenerated its sensory mechanism it too returned home. It was concluded that homing ability in salamanders is direction independent, distant dependent, and vision independent. E.H.W.

N72-25093*# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).

ANEMOMENOTATIC ORIENTATION IN BEETLES AND SCORPIONS

K. Eduard Linsenmair *In* NASA, Washington Animal Orientation and Navigation 1972 p 501-510 refs (See N72-25062 16-04)

Avail: NTIS; SOD $5.75 CSCL 06C

Orientation, by beetles and scorpions, according to wind direction and force are analyzed. Major efforts were made to determine: (1) which physical qualities of the air current influence anemomenotaxis, (2) which physiological mechanism is responsible for such orientation, (3) which sense organs do beetles and scorpions use to perceive wind directions, and (4) what the biological significance of anemomenotaxis in the beetle and scorpion is. Experimental results show that the trichobothria in scorpions perceives wind direction; in the beetle it is perceived by sense organs excited by pendicellus-flagellum joint movements. A compensation mechanism is suggested as the basis for anemomenotactic orientation. It was also suggested that the biological significance of anemomenotaxis in scorpions is space orientation; while in beetles it was found to be part of the appetitive behavior used to search for olfactory sign stimuli. E.H.W.

N72-25094*# Hokkaido Univ., Sapporo (Japan).

AZIMUTH ORIENTATION OF THE DRAGONFLY (SYMPETRUM)

Mituhiko Hisada *In* NASA, Washington Animal Orientation and Navigation 1972 p 511-522 refs (See N72-25062 16-04)

Avail: NTIS; SOD $5.75 CSCL 06C

Evidence is presented of directional orientation by an alighting dragonfly relative to the azimuth of the sun. The effects of wind direction on this orientation are analyzed. It was concluded that wind does not play a major role in orientation but may have some secondary function in helping greater numbers of dragonflies face windward more often than leeward. A search was made to find the principle sensory receptor for orientation. Two possibilities, the large compound eye and the frontal ocelli, were noted; however, no conclusive evidence could be found. E.H.W.

N72-25095*# Scripps Institution of Oceanography, San Diego, Calif.

WHEN THE BEACHHOPPER LOOKS AT THE MOON: THE MOON COMPASS HYPOTHESIS

James T. Enright *In* NASA, Washington Animal Orientation and Navigation 1972 p 523-555 refs (See N72-25062 16-04)

(Grants NSF GB-2469; NSF GB-5471)

Avail: NTIS; SOD $5.75 CSCL 06C

The function of moon position for shoreline orientation by talitrids is investigated. Three major results were found: (1) Observed cases of compensation for changes in the direction of the moon are based on physiological rhythm with a period of about 25 hours which can persist for at least several days under constant conditions. (2) The zeitgeber for physiological rhythm may be either moonlight or some other factor associated with the tides. (3) If talitrids are long removed from environmental entrainment, either artifically or naturally, the internal rhythm no

longer exerts an appreciable influence on the angle of lunar orientation; in such cases the system deteriorates into constant angle orientation, with an angle which is determined by the beach orgin, but may be modified by lighting conditions. E.H.W.

N72-25096*# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).
MAGNETIC EFFECT ON DANCING BEES
Martin Lindauer and Herman Martin *In* NASA, Washington Animal Orientation and Navigation 1972 p 559-567 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

Bee sensitivity to the earth's magnetic field is studied. Data cover sensitivity range and the use of magnetoreception for orientation purposes. Experimental results indicate bee orientation is aided by gravity fields when the magnetic field is compensated. E.H.W.

N72-25097*# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).
THE INFLUENCE OF MAGNETIC TOTAL INTENSITY AND INCLINATION ON DIRECTIONS PREFERRED BY MIGRATING EUROPEAN ROBINS (ERITHACUS RUBECULA)
Wolfgang Wiltschko *In* NASA, Washington Animal Orientation and Navigation 1972 p 569-578 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 06C

The directional orientation of migratory European robins in relation to magnetic cues is analyzed. Major efforts were made to determine what information the birds derive from the fields. It was determined that magnetic fields provide: (1) field intensity which determines whether the magnetic field can be used for orientation, (2) a means by which axial direction may be perceived, and (3) a means by which the bird can find the north direction. The north direction is sensed from the angle between gravity and the magnetic field. E.H.W.

N72-25098*# Cornell Univ., Ithaca, N.Y.
EFFECTS OF MAGNETS ON PIGEON HOMING
William T. Keeton *In* NASA, Washington Animal Orientation and Navigation 1972 p 579-594 refs (See N72-25062 16-04)
(Grant NSF GB-13046X)
Avail: NTIS; SOD $5.75 CSCL 06C

The function of magnets in the navigation system of homing pigeons is investigated. Only experienced pigeons with magnets or brass bars were studied. Data show that on sunny days, pigeons with the magnets had some difficulty in orientation while those with brass bars had no problems. The same experiment was repeated on cloudy days. These results show that the magnets did not interfere with orientation. This difference suggests that sun and magnetic cues are used interchangeably, but that both together seldom function. E.H.W.

N72-25099*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: PROCESSING OF LUNAR SAMPLES IN A STERILE NITROGEN ATMOSPHERE
Thomas M. McPherson Washington Jun. 1972 16 p
(NASA-TN-D-6858; MSC-S-332) Avail: NTIS HC $3.00 CSCL 03B

A sterile nitrogen atmosphere processing cabinet line was installed in the Lunar Receiving Laboratory to process returned lunar samples with minimum organic contamination. Design and operation of the cabinet line were complicated by the requirement for biological sterilization and isolation, which necessitated extensive filtration, leak-checking, and system sterilization before use. Industrial techniques were applied to lunar sample processing to meet requirements for time-critical experiments while handling a large flow of samples. Author

N72-25100*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: PROTECTION OF LIFE AND HEALTH
Bennie C. Wooley Washington Jun. 1972 32 p
(NASA-TN-D-6856; MSC-S-328) Avail: NTIS HC $3.00 CSCL 06P

The development, implementation, and effectiveness of the Apollo Lunar Quarantine Program and the Flight Crew Health Stabilization Program are discussed as part of the broad program required for the protection of the life and health of U.S. astronauts. Because the goal of the Apollo Program has been the safe transport of men to the moon and back to earth, protection of the astronauts and of the biosphere from potentially harmful lunar contaminants has been required. Also, to ensure mission success, the continuing good health of the astronauts before and during a mission has been necessary. Potential applications of specific aspects of the health and quarantine programs to possible manned missions to other planets are discussed. Author

N72-25101*# Midwest Research Inst., Kansas City, Mo.
BIOMEDICAL APPLICATIONS OF AEROSPACE TECHNOLOGY Final Report, 1 Aug. 1970 - 31 Oct. 1971
Thomas R. Castles 31 Oct. 1971 175 p
(Contract NASw-1936; MRI Proj. 3332-E(D))
(NASA-CR-126773) Avail: NTIS HC $10.75 CSCL 06E

Aerospace technology transfer to biomedical research problems is discussed, including transfer innovations and potential applications. Statistical analysis of the transfer activities and impact is also presented. J.A.M.

N72-25102*# SysteMed Corp., Newport Beach, Calif.
EFFECT OF 90-DAY CONTINUOUS EXPOSURE TO METHYLISOBUTYLKETONE ON DOGS, MONKEYS AND RATS
J. D. MacEwen, E. H. Vernot, and C. C. Haun Wright-Patterson AFB, Ohio AMRL Jun. 1971 23 p refs
(NASA Order T-64130G; Contract F33615-70-C-1046; AF Proj. 6302)
(NASA-CR-126744; W-71003; AMRL-TR-71-65) Avail: NTIS HC $3.25 CSCL 06C

Continuous exposure of rats, dogs and monkeys to 410 mg/cu M methylisobutylketone vapor (MIBK) was conducted to evaluate the provisional spacecraft exposure limit of 20 ppm established by the Space Science Board in 1968. The exposure, conducted in a simulated space cabin environment, did not produce any measurable changes in dogs or monkeys. Rats developed hyaline droplet nephrosis within 2 weeks of exposure which was reversible upon removal from the MIBK even after 90 days. The data obtained indicated that the 60-minute emergency exposure limit of 100 ppm and the 90- and 1000-day provisional limits as established by the Space Science Board contain a wide margin of safety. Author

N72-25103# Civil Aeromedical Inst., Oklahoma City, Okla.
INDEX TO FAA OFFICE OF AVIATION MEDICINE REPORTS: 1961 THROUGH 1971
J. Robert Dille and Marcia H. Grimm Mar. 1972 29 p refs
(FAA-AM-72-1) Avail: NTIS HC $3.50

An index to Office of Aviation Medicine Reports (1964 to 71) and Civil Aeromedical Research Institute Reports (1961 to 63) is presented as a quick reference for those engaged in aviation medicine and related activities. It provides a listing of all FAA aviation medicine reports published from 1961 through 1971 by year, number, author, subject, and title. Author

N72-25104# Civil Aeromedical Inst., Oklahoma City, Okla.
ATTRITION FROM ACTIVE AIRMAN STATUS DURING 1970
Charles F. Booze, Jr. Mar. 1972 29 p refs
(FAA-AM-72-13) Avail: NTIS HC $3.50

Attrition from an active airman status amounts to approximately 17% annually. Summary data presented have served to quantify, to some extent, the characteristics of airmen medically certified during 1968 subsequently becoming inactive during 1970. The contribution of medical factors to attrition was considered as well as experience, occupation, usage, and geographic characteristics. Population comparisons and prevalence rates are also presented for the various medical factors considered. Disenchantment and/or economic considerations appear to be the most important factors associated with attrition. Medical factors do not contribute substantially to attrition. Author

N72-25105*# Exotech, Inc., Washington, D.C.
EVALUATION OF MICROBIAL RELEASE PROBABILITIES Interim Report
Apr. 1972 60 p refs
(Contract NASw-2062)
(NASA-CR-126846; TR72-12) Avail: NTIS HC $5.00 CSCL 06M

Work undertaken to improve the estimation of the probability of release of microorganisms from unmanned Martian landing spacecraft is summarized. An analytical model is described for the development of numerical values for release parameters and release mechanisms applicable to flight missions are defined. Laboratory test data are used to evolve parameter values for use by flight projects in estimating numerical values for release probabilities. The analysis treats microbial burden located on spacecraft surfaces, between mated surfaces, and encapsulated within materials. Author

N72-25106# Joint Publications Research Service, Arlington, Va.
PLANT CULTIVATION IN SPACE
Arnold Miller 30 May 1972 8 p Transl. into ENGLISH from Nauka i Tekhn. (USSR), no. 2, 1972 p 17-23
(JPRS-56129) Avail: NTIS HC $3.00

Cultivation of plants in a closed system in space flight is discussed. Weightlessness and radiation effects on plant metabolism are considered. Author

N72-25107# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE HYDROLOCATION CAPABILITY OF DOLPHINS
G. B. Agarkov, B. V. Solukha, and B. G. Khomenko [1971] 7 p refs Transl. into ENGLISH from Bionika (Kiev), no. 5, 1971 p 52-57
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The hydrolocator mechanism of the dolphin is analyzed with an eye toward using some of its elements in technology. The system consists of two parts: the transmitter and the receiver. The transmitter is a system of air saccules, larynx, fatty lens, and a reflector; the receiver is the hearing organ, the mechanoreceptors of the head, the upper jaw, and the lower jaw. The accuracy of locating the direction, image, and range of an object by the dolphin is calculated. Author

N72-25108# Civil Aeromedical Inst., Oklahoma City, Okla.
EFFECTS OF ALCOHOL ON A PROBLEM SOLVING TASK
W. Dean Chiles and Alan E. Jennings Mar. 1972 11 p refs
(FAA-AM-72-11) Avail: NTIS HC $3.00

Twenty subjects were tested on two separate days on a simple problem solving task. Half of the subjects received alcohol on the first day of testing and half on the second day of testing. A control group of 11 subjects was also tested on two days and they were given a placebo on the first day of testing. All 31 subjects were also serving in a vestibular stimulation experiment. A significant effect was found for alcohol with five of the eleven measures analyzed; four of the measures were time measures and one was an error measure. Analysis of the simple effects indicated that alcohol had a greater effect on the group that had alcohol on the first session than on the group that had alcohol second. There was also suggestive evidence of a residual effect of the vestibular stimulation on the problem solving performance of the control group. In general, the findings provide supportive evidence of the potential deleterious effects of alcohol on a skill of importance to aviation operations. Author

N72-25109# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex.
FISSION PRODUCT INHALATION PROGRAM Annual Report, 1 Oct. 1970 - 30 Sep. 1971
R. O. McClellan, ed. and F. C. Rupprecht, ed. Nov. 1971 373 p refs
(Contract AT(29-2)-1013)
(LF-44) Avail: NTIS

Fifty-one papers related to research conducted from October 1970 to October 1971 at the Lovelace Foundation on the biological effects of radioisotope inhalation are presented. A separate abstract was prepared for each of 42 papers. Nine were not within the scope of NASA. These nine include information on the production of laboratory dogs, methods for handling canine blood and tissue samples, chemical studies of lungs, methods for handling laboratory data, and the effects of bronchopulmonary lavage in dogs. NSA

N72-25110# Technology, Inc., Dayton, Ohio.
GROSS BEHAVIOR OF THE BODY'S GLUTEAL REGION Final Report
Robert R. Yeager 30 Dec. 1971 105 p refs
(Contract N00156-71-C-0854)
(AD-737225; TI-415-71-1; NADC-CS-7121) Avail: NTIS CSCL 06/19

A research program was conducted to study the behavior of the human body's gluteal region when the body is restricted to a sitting erect configuration. The specific objective was establishing the force-deflection behavior of the buttock tissue for longitudinal body loads above and below normal body weight. To this end 14 human subjects were tested for thigh bone displacements relative to a seating platform as their bodies were lowered onto the seat. Body loadings in excess of normal weight were then produced by adding a series of weights to the shoulders of each subject. Test results indicate that the buttocks exhibit primarily non-linear hardening behavior. Displacements for relaxed subjects can double those for stiffened subjects. Author (GRA)

N72-25111# IIT Research Inst., Chicago, Ill.
SUSCEPTIBILITY OF CARDIAC PACEMAKERS TO ELF MAGNETIC FIELDS
J. E. Bridges, E. E. Brueschke, M. P. Kaye, D. A. Miller, and C. D. Port Apr. 1971 130 p refs
(Contract N00039-71-C-0111)
(AD-737237; IITRI-E6185-1) Avail: NTIS CSCL 06/18

In the report it is concluded that the extremely low frequency (ELF) magnetic field levels which interfere with the operation of cardiac pacemakers are much greater than those expected from a conceptual defense SANGUINE communication system. This conclusion is based on an experimental program in which the effect of extremely low frequency (10-100 HZ) magnetic fields on cardiac pacemakers was studied. Objectives of the program were to determine a safe level (threshold) for a magnetic field in this frequency range and to establish a method and criterion for evaluating the interference effects. Examples of electromagnetic fields affecting implanted heart pacemakers are presented. Author (GRA)

N72-25112# Air Force Academy, Colo.
AUDITORY EFFECTS ON SPATIAL ORIENTATION
L. R. Chason, T. P. McFarland, and T. B. Aldrich Nov. 1971 32 p refs
(AD-737351; USAFA-RR-71-10) Avail: NTIS CSCL 06/6

The purpose of this study was to isolate and investigate specialized auditory stimuli with respect to spatial orientation. An evaluation of subject's ability to use frequency specific binaural clues and vision, separately and in combination, in

setting the horizontal position of a rod-and-frame device was performed. The data demonstrated that the auditory clues improved performance regardless of the presence of visual stimuli. The combination of auditory and visual clues provided the optimal arrangement. The implications for human factors design in aircraft systems are discussed. Author (GRA)

N72-25113# Naval Submarine Medical Center, Groton, Conn.
REDUCTION IN AUDIOGRAM SHIFTS IN SOLAR WATCHSTANDERS WHEN EXPOSED TO SURFACE SHIP ECHO RANGING
J. Donald Harris 21 May 1971 14 p refs
(AD-737207; NSMRL-MR-71-4;
NAVMED-MF12.524.004-9010D) Avail: NTIS CSCL 06/19

Audiograms collected underway on sonar technicians on USS GATO (SSN 615) during exposure to echo-ranging 19 - 31 January 1971 showed that SPLs in the sonar headsets may be hazardous to hearing. Two of three headsets were modified by NUSC/NLON so as to limit the peak SPLs delivered to the ear. On a cruise 21 - 31 March 1971, during which light to moderately heavy echo-ranging was encountered, 6 men using an unmodified headset, were exposed to SPLs up to 118 dB. In half the 12 ears a temporary hearing loss was found which exceeded a widely-disseminated damage-risk criterion. However, of 6 men who used modified headsets, no average loss whatever was found, and only 1 ear slightly exceeded the criterion. Whether the modification introduced on this occasion was an optimal compromise between protecting the ears vs obtaining all possible information from the sea, is still an open question. Further studies are in progress. Author (GRA)

N72-25114# Naval Submarine Medical Center, Groton, Conn.
THE VISUAL EVOKED RESPONSE AS A MEASURE OF NITROGEN NARCOSIS IN NAVY DIVERS
Jo Ann S. Kinney and Christine L. McKay 24 Apr. 1971 25 p refs
(AD-737208; NSMRL-664; NAVMED-MF12.524.004-9015D)
Avail: NTIS CSCL 06/19

The study assesses the possible use of the visual evoked response as a measure of nitrogen narcosis in divers. Responses to a patterned visual target were recorded from the scalp over the occipital cortex, from divers breathing air in the NAVSUBMEDRSCHLAB's pressure chamber. Records were obtained at the surface, and at 100, 200, and 250 feet. Control dives to 250 ft with the same men breathing helium-oxygen were also performed. The results showed significant decreases in amplitude and regularity of the visual evoked response as a function of depth for divers breathing air but not comparable decrements with helium-oxygen. Author (GRA)

N72-25115# Naval Submarine Medical Center, Groton, Conn.
THE VISUAL EVOKED CORTICAL RESPONSE AS A MEASURE OF STRESS IN NAVAL ENVIRONMENTS: METHODOLOGY AND ANALYSIS. 1: SLOW FLASH RATES
Jo Ann S. Kinney, Christine L. McKay, A. Mensch, and S. M. Luria 25 Jun. 1971 33 p refs
(AD-737209; NSMRL-669;
NAVMED-MR005.01.01-0130BOLL-01) Avail: NTIS CSCL 06/19

The emphasis in this report is upon methodology for use in evaluating the visual evoked response (VER), since our primary interest is in using it as a tool in the study of Naval problems. In order to employ the VER to full advantage, techniques have to be evolved to assess the significance of differences among evoked responses; two such methods are assessed in this paper. One of these, a determination of a mean VER, is effective in evaluating the statistical significance of subtle differences among evoked responses. The second technique is designed to isolate differences in underlying processes in the VER by summating responses to one stimulus and subtracting the same number of responses to another. In the course of these investigations, we have found an element in the VER strongly responsive to patterned stimuli and small differences among VER's attributable to hue. The latter are in excellent agreement with psychophysical data on the color response of normal and color defective subjects. Author (GRA)

N72-25116# Man Factors, Inc., San Diego, Calif.
EXPERIMENTAL STUDY OF DIVER PERFORMANCE IN MANUAL AND MENTAL TASKS AT 66 FEET
Irving Streimer, D. P. W. Turner, P. Pryor, and Kent Volkmer Sep. 1971 106 p refs
(Contract N00014-70-C-0189; NR Proj. 196-070)
(AD-737376; MFI-71-115) Avail: NTIS CSCL 06/19

Certain human performance characteristics developed during the execution of relatively complex work at a depth of 66 feet were studied. The tasks examined were: (1) A complex maintenance task involving the disassembly and reassembly of a water filtration unit. (2) A mental task involving the processes of numerical reasoning, digit memory span and pattern perception. The principal findings may be summarized as follows: (1) Irrespective of the task nature, energy expenditure rates during manual work remain remarkably constant. (2) Differences in task nature or difficulty are manifested by changes in productivity while energy expenditure rates remain constant. (3) Breathing gas consumption rates vary as a function of depth. (4) The percentage of oxygen removed from the available oxygen varies as a function of the energy investment level. Author (GRA)

N72-25117# Texas Christian Univ., Fort Worth. Inst. for the Study of Cognitive Systems.
PROCEEDINGS OF THE MIDWESTERN PSYCHOLOGICAL ASSOCIATION SYMPOSIUM ON MULTIVARIATE APPROACHES TO PATTERN PERCEPTION
Selby H. Evans Dec. 1971 146 p refs Symp. held at Detroit, May 1971
(Contract DAAD05-68-C-0176; DA Proj. 1T0-61102-B-81 A)
(AD-737268; HEL-TM-25-71) Avail: NTIS CSCL 05/10

Contents: Property analyzers in pattern perception; Toward a union of feature analysis and class synthesis approaches to pattern perception; New dimensions in psychophysics--A sure cure for methodological dyspepsia; Discussion. GRA

N72-25118# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE EFFECTIVENESS OF BENACTYZINE HYDROCHLORIDE AND OTHER ANTIMOTION SICKNESS DRUGS IN NEW COMBINATIONS
D. Charles Wood, and Ashton Graybiel 6 Feb. 1971 9 p refs
(AD-737220; NAMRL-1152;
NAVMED-MF12.524.005-7015BX8X-1) Avail: NTIS CSCL 06/15

Five different drug preparations are compared for their effectiveness in preventing motion sickness with the effectiveness found for the combination of scopolamine 0.6 mg with d-amphetamine 10 mg in previous studies. Promethazine 25 mg plus d-amphetamine 10 mg was essentially equal to the baseline drug in range of effectiveness. Halving the doses of the baseline combination did not provide the protection that it did in an earlier study. Benactyzine 3 mg was only slightly effective and when combined with d-amphetamine 10 mg was only moderately so. Promethazine 25 mg plus ephedrine 25 mg was about one-fourth less effective than the baseline preparation. The unexpected finding of the efficacy of small doses (25 mg) of promethazine plus ephedrine is pointed out, and the benefits from the relatively great reduction in side effects found with this drug combination are stressed. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-25119* United Aircraft Corp., East Hartford, Conn.
RESTRAINT TORSO FOR A PRESSURIZED SUIT Patent
Michael A. Marroni, Jr., inventor (to NASA) Issued 9 May 1972 11 p Filed 20 Dec. 1968 Sponsored by NASA
(NASA-Case-MSC-12397-1; US-Patent-3,660,851; US-Patent-Appl-SN-785613; US-Patent-Class-2-2.1; US-Patent-Class-2-115) Avail: US Patent Office CSCL 06Q

A restraint torso, for a pressurized suit, fabricated from cloth is described. The restraint is fashioned so that mobility will increase and physiological effects to the wearer will decrease. A belt is provided so that together with the cloth design, the torso will be held flat under pressure. Precise cloth patterns and illustrations are included. E.H.W.

N72-25120* Institute for Research, Houston, Tex.
METHOD OF MAKING A PERSPIRATION RESISTANT BIOPOTENTIAL ELECTRODE Patent
Benjamin Mosier and Joe L. Day, inventors (to NASA) Issued 23 May 1971 5 p Field 9 May 1969 Continuation-in-part of US Patent Appl. SN-607461, filed 5 Jan. 1967 sponsored by NASA
(NASA-Case-MSC-90153-2; US-Patent-3,665,064; US-Patent-Appl-SN-844225; US-Patent-Class-264-104; US-Patent-Class-106-209; US-Patent-Class-128-2.1; US-Patent-Class-128-417; US-Patent-Class-252-514) Avail: US Patent Office CSCL 06B

The forming technique used to make a biopotential electrode is described. A 5 to 15 percent colloidal material, acting as a screen against undesirable perspiration ions, is added to a conventional biopotential electrode mixture. This colloidal material is selected from various gums, bentenite clay, and a magnesium silicate clay-like material. The mixture is pressed into shape around an electrode wire after being subjected to a partial vacuum. Official Gazette of the U.S. Patent Office

N72-25121* Northrop Nortronics, Palos Verdes Peninsula, Calif.
METHOD OF MAKING DRY ELECTRODES Patent
Frank B. Ramme, inventor (to NASA) Issued 16 May 1972 5 p Filed 7 Oct. 1970 Supersedes N72-13081 (10 - 04, p 422) Continuation-in-part of US Patent Appl. SN-760389, filed Aug. 1968 sponsored by NASA
(NASA-Case-FRC-10029-2; US-Patent-3,662,441; US-Patent-Appl-SN-78704; US-Patent-Class-29-25.14; US-Patent-Class-29-25.18; US-Patent-Class-29-630A; US-Patent-Class-29-482; US-Patent-Class-156-308; US-Patent-Class-156-264) Avail: US Patent Office CSCL 06D

Dry electrodes are made by mixing silver powder with a cement, diluting the mixture with a suitable solvent for the cement, and applying it in a thin layer to a surface from which it can be removed as a film when dry. Cutting or shaping the dried film to form the size electrodes is desired. Placing a wire lead on the cut film piece and applying a small amount of solvent to the film surface are reviewed. Pressing a second piece of the dried film to form the electrode of the invention is also performed.
Official Gazette of the U.S. Patent Office

N72-25122* General Electric Co., Philadelphia, Pa.
METHOD FOR MEASURING CUTANEOUS SENSORY PERCEPTION Patent
Robert W. Richardson and David B. Wright, inventors (to NASA) Issued 16 May 1972 5 p Filed 2 Dec. 1970 Supersedes N72-15095 (10 - 06, p 726) Sponsored by NASA
(NASA-Case-MSC-13609-1; US-Patent-3,662,744; US-Patent-Appl-SN-94347; US-Patent-Class-128-2N) Avail: US Patent Office CSCL 06B

The method utilizes an instrument comprised of elongated tubular housing having a sleeve member extending axially. Mounted on the other end of the tubular housing is a vernier counter adjustment. Telescopically positioned within the sleeve is a thin wire-like member or monofilament stimulating element. One end of the monofilament stimulating element extends from the sleeve while the other end is mechanically coupled to the internal operating mechanism of the vernier counter adjustment.
Official Gazette of the U.S. Patent Office

N72-25123 Kansas Univ., Lawrence.
A PULSE MODULATED BIOTELEMETRY SYSTEM FOR MONITORING HEART RATE AND BODY TEMPERATURE IN FREE RANGING VERTEBRATES Ph.D. Thesis
James Donald Pauley 1971 212 p
Avail: Univ. Microfilms Order No. 71-27191

To carry out a study of energy budgeting in free-ranging vertebrates, such as the opossum, raccoon, or marmot, it was necessary to develop a biotelemetry system to obtain heart rate and body temperature as an index of metabolic rate and stored thermal energy. The transmitter for the biotelemetry system consisted of two electrodes placed in the M-X (manubrium-xyphoid) configuration and an electronic package measuring 4 x 5 x 1 cm. The ECG signal picked up by the electrodes was amplified and the QRS complex detected. A sample computer program is presented which tabulates the collected data for a period of up to two weeks and computes and tabulates average heart rates and body temperatures for each hour of the day using the data obtained over the period of data collection. Examples are given for two different female opossums which clearly show diurnal body temperature fluctuations and suggest diurnal heart rate patterns. Dissert Abstr.

N72-25124*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
UNDERWATER SPACE SUIT PRESSURE CONTROL REGULATOR Patent Application
Billy R. Aldrich, Charles R. Cooper, and John R. Rasquin, inventors (to NASA) Filed 2 Nov. 1971 17 p
(NASA-Case-MFS-20332-2; US-Patent-Appl-SN-195061) Avail: NTIS HC $3.00 CSCL 06K

A device for regulating the pneumatic pressure in a ventilated space suit relative to the pressure imposed on the suit when being worn by a person underwater is described. A box unit located on the chest area of the suit comprises connections for suit air supply and return lines and carries a regulator valve that stabilizes the air pressure differential between the inside and outside of the suit. The valve and suit pressure is controlled by the suit occupant and the valve includes a mechanism for quickly dumping the suit pressure in case of emergency. Pressure monitoring and relief devices are also included in the box unit.
NASA

N72-25125*# Westinghouse Electric Corp., Pittsburgh, Pa.
DEVELOPMENT OF A SOLID ELECTROLYTE CARBON DIOXIDE AND WATER REDUCTION SYSTEM FOR OXYGEN RECOVERY
L. Elikan, J. P. Morris, and C. K. Wu Washington NASA May 1972 182 p refs
(Contract NAS1-8896)
(NASA-CR-2014) Avail: NTIS HC $3.00 CSCL 06K

A 1/4-man solid electrolyte oxygen regeneration system, consisting of an electrolyzer, a carbon deposition reactor, and palladium membranes for separating hydrogen, was operated continuously in a 180-day test. Oxygen recovery from the carbon dioxide-water feed was 95%. One percent of the oxygen was lost to vacuum with the hydrogen off-gas. In a space cabin, the remaining 4% would have been recycled to the cabin and recovered. None of the electrolysis cells used in the 180-day test failed. Electrolysis power rose 20% during the test; the average

power was 283.5 watts/man. Crew time was limited to 18 min/day of which 12 min/day was used for removing carbon. The success achieved in operating the system can be attributed to an extensive component development program, which is described. Stability of operation, ease of control, and flexibility in feed composition were demonstrated by the life test. Author

N72-25126*# Hamilton Standard, Windsor Locks, Conn.
SPACE SHUTTLE ENVIRONMENTAL CONTROL/LIFE SUPPORT SYSTEMS
Washington NASA May 1972 430 p refs
(Contract NAS1-10359)
(NASA-CR-1981; SVHSER-5851) Avail: NTIS HC $6.00 CSCL 06K

This study analyzes and defines a baseline Environmental Control/Life Support System (EC/LSS) for a four-man, seven-day orbital shuttle. In addition, the impact of various mission parameters, crew size, mission length, etc. are examined for their influence on the selected system. Pacing technology items are identified to serve as a guide for application of effort to enhance the total system optimization. A fail safe-fail operation philosophy was utilized in designing the system. This has resulted in a system that requires only one daily routine operation. All other critical item malfunctions are automatically resolved by switching to redundant modes of operation. As a result of this study, it is evident that a practical, flexible, simple and long life, EC/LSS can be designed and manufactured for the shuttle orbiter within the time phase required. Author

N72-25127*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TILTING TABLE FOR ERGOMETER AND FOR OTHER BIOMEDICAL DEVICES Patent Application
Raymond L. Gause and Raymond A. Spier, inventors (to NASA) Filed 8 May 1972 19 p
(NASA-Case-MFS-21010-1; US-Patent-Appl-SN-251609) Avail: NTIS HC $3.00 CSCL 06B

A device for testing the human body in a variety of positions, ranging from the vertical to the supine, while exercising on an ergometer is described. The device can also be used for angular positioning of other biomedical devices. It includes a floor plate and a hinged plate upon which to fix the ergometer, a back rest and a head rest attached at right angles to the plate and behind the seat of the ergometer, and dual hydraulic cylinders for raising and lowering the hinged plate through 90 degrees. Tests can be made with the subject positioned on the seat of the ergometer, through the various angles, with a substantially normal body attitude relative to the seat and ergometer. NASA

N72-25128*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A STUDY OF PILOT MODELING IN MULTI-CONTROLLER TASKS Final Report
Richard F. Whitbeck and James R. Knight Mar. 1972 135 p refs
(Contract NAS1-10514)
(NASA-CR-112048; CAL-IH-3037-J-1) Avail: NTIS HC $8.75 CSCL 05E

A modeling approach, which utilizes a matrix of transfer functions to describe the human pilot in multiple input, multiple output control situations, is studied. The approach used was to extend a well-established scalar Wiener-Hopf minimization technique to the matrix case and then study, via a series of experiments, the data requirements when only finite record lengths are available. One of these experiments was a two-controller roll tracking experiment designed to force the pilot to use rudder in order to coordinate and reduce the effects of aileron yaw. One model was computed for the case where the signals used to generate the spectral matrix are error and bank angle while another model was computed for the case where error and yaw angle are the inputs. Several anomalies were observed to be present in the experimental data. These are defined by the descriptive terms roll up, break up, and roll down. Due to these algorithm induced anomalies, the frequency band over which reliable estimates of power spectra can be achieved is considerably less than predicted by the sampling theorem. Author

N72-25129*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TEMPERATURE CONTROLLER FOR A FLUID COOLED GARMENT Patent Application
Allan B. Chambers, James R. Blackaby, and John Billingham, inventors (to NASA) Filed 25 Apr. 1972 21 p
(NASA-Case-ARC-10599-1; US-Patent-Appl-SN-247481) Avail: NTIS HC $3.25 CSCL 06Q

An automatic temperature controller is described for the fluid inlet to a liquid cooled garment which is worn underneath an air ventilated suit. The inlet coolant temperature is controlled as a function of wearer's evaporative water loss. The water loss rate is obtained by the incremental change in a hygrometer reading of the outlet air stream of the air ventilated garment with respect to a basal outlet air stream hygrometer reading that provides comfort for the wearer in a sedentary mode. F.O.S.

N72-25130# Civil Aeromedical Inst., Oklahoma City, Okla.
PILOT TRACKING PERFORMANCE DURING SUCCESSIVE IN-FLIGHT SIMULATED INSTRUMENT APPROACHES
Paul G. Rasmussen and A. Howard Hasbrook Feb. 1972 22 p refs
(FAA-AM-72-9) Avail: NTIS HC $3.25

Eight instrument rated pilots with flying experience ranging from 600 to 12,271 hours each flew 10 simulated ILS instrument approaches in a single engine, general aviation aircraft equipped with a primary flight display arranged in a conventional T configuration. Continuous glide slope and localizer tracking performance was recorded during each approach. Approaches were flown consecutively at approximately 10-minute intervals, with a one-minute in-flight rest period prior to each approach. The principal finding was that there were no statistically significant changes in glide slope tracking with respect to accuracy of tracking or consistency of performance as a result of the practice afforded by the ten approaches. Some performance measures did yield statistically significant changes in localizer tracking performance, but these changes were of a small order of magnitude. Results are discussed in terms of the factors operating to limit the precision with which the glide slope and localizer can be tracked. Author

N72-25131# Civil Aeromedical Inst., Oklahoma City, Okla.
PHYSIOLOGICAL EVALUATION OF A MODIFIED JET TRANSPORT PASSENGER OXYGEN MASK
Ernest B. McFadden Mar. 1972 18 p refs
(FAA-AM-72-10) Avail: NTIS HC $3.00

Altitude chamber experiments conducted with human subjects are described. The experiments were conducted with new continuous flow disposable passenger mask applicable for emergency use to maximum altitudes of 41,000 feet. This mask design differs in configuration from the previous omni-directional masks in that the inner face flap or seal is eliminated and the cylindrical shape reduced to a modified cone. The primary goal was to determine if design modification of the mask induced an increase or decrease in physiological efficiency. Of paramount concern was the possibility that modification of the configuration and facial seal might increase the leakage rate of ambient air into the mask, and thereby compromise its ability to provide the level of protection required at the maximum altitude of the aircraft. The mask was evaluated at altitudes of 14,000, 21,500, 29,000, 35,000 and 40,000 feet. Author

N72-25132# Civil Aeromedical Inst., Oklahoma City, Okla.
THE COLOR-WORD INTERFERENCE TEST AND ITS RELATION TO PERFORMANCE IMPAIRMENT UNDER AUDITORY DISTRACTION
Richard I. Thackray, Karen N. Jones, and Robert M. Touchstone

Mar. 1972 10 p refs
(FAA-AM-72-14) Avail: NTIS HC $3.00

An examination was made of the relationship between performance on the Stroop color-word interference test (a suggested measure of distraction susceptibility) and impairment under auditory distraction on a task requiring the subject to generate random sequences of letters. Fifty male college students served as subjects. Although there was a significant decrease in randomness as a result of auditory distraction, the correlation between change in randomness and amount of color-word interference was nonsignificant. These findings, along with those of several other studies, suggest that the Stroop test may measure a rather restricted type of perceptual interference essentially unrelated to a possibly more general ability to maintain concentration in the presence of competing (distracting) stimuli. Author

N72-25133*# Vought Missiles and Space Co., Dallas, Tex.
ADVANCED EXTRAVEHICULAR PROTECTIVE SYSTEM (AEPS) STUDY
J. L. Williams, B. W. Webbon, and R. J. Copeland Mar. 1972 149 p refs
(Contract NAS2-6022)
(NASA-CR-114382; T141RP007) Avail: NTIS HC $9.50 CSCL 06K

A summary is presented of Advanced Extravehicular Protective Systems (AEPS) for the future missions beyond Skylab in earth orbit, on the lunar surface, and on the Martian surface. The study concentrated on the origination of regenerable life support concepts for use in portable extravehicular protective systems, and included evaluation and comparison with expendable systems, and selection of life support subsystems. The study was conducted in two phases. In the first phase, subsystem concepts for performing life support functions in AEPS which are regenerable or partially regenerable were originated, and in addition, expendable subsystems were considered. Parametric data for each subsystem concept were evolved including subsystem weight and volume, power requirement, thermal control requirement; base regeneration equipment weight and volume, requirement. The second phase involved an evaluation of the impact of safety considerations involving redundant and/or backup systems on the selection of the regenerable life support subsystems. In addition, the impact of the space shuttle program on regenerable life support subsystem development was investigated. Author

N72-25134*# Life Systems, Inc., Cleveland, Ohio.
ONE-MAN, SELF-CONTAINED CO2 CONCENTRATING SYSTEM Final Report
R. A. Wynveen, F. H. Schubert, and J. D. Powell Mar. 1972 78 p refs
(Contract NAS2-6118)
(NASA-CR-114426; LSI-ER-131-16) Avail: NTIS HC $6.00 CSCL 06K

A program to design, fabricate, and test a 1-man, self-contained, electrochemical CO2 concentrating system is described. The system was designed with electronic controls and instrumentation to regulate performance, to analyze and display performance trends, and to detect and isolate faults. Ground support accessories were included to provide power, fluids, and a Parametric Data Display allowing real time indication of operating status in engineering units. Author

N72-25135# Joint Publications Research Service, Arlington, Va.
CYBERNETICS RESEARCH REPORTED
23 May 1972 74 p refs Transl. into ENGLISH from Avtomatyka (Kiev), no. 6, 1971
(JPRS-56072) Avail: NTIS HC $5.75

Articles are presented on mathematical modeling, automata theory, speech synthesis by computers, mechanical model of heart and lungs, and logistics curves for prediction purposes. For individual titles, see N72-25136 through N72-25141.

N72-25136# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF COMPLEX SYSTEM MODELING AND APPLIED MATHEMATICAL STATISTICS c19
O. G. Ivakhnenko *In its* Cybernetics Res. Reported 23 May 1972 p 1-13 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

Modeling techniques are discussed for predicting events and trends of complex systems such as those connected with urban, economic, and industrial planning and meteorological and ecological systems. A system of regression equations is used, and Group Method of Determining Arguments (GMDA) algorithms are employed for intermediate and long term predictions as well as short term forecasting. Strengths and weaknesses of statistical models, goal-directed choice of external supplements, nonsubstantial mathematical models, and the syntheses of models in the absence of experimental data by GMDA algorithms are described. It is concluded that the GMDA algorithms based on self-organization give new solutions to problems of modeling complex systems, and that one virtue is that they are always logically nonsubstantial. N.E.N.

N72-25137# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF AXIOMATIC APPROACH TO THE CONSTRUCTION OF THE THEORY OF LOGIC-DYNAMIC CONTROL SYSTEMS, PART 2 c10
K. D. Zhuk *In its* Cybernetics Res. Reported 23 May 1972 p 14-29 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

The properties are discussed of the proof of the existence and uniqueness of the solution of n differential equations of the first order used for the axiomatic construction of dynamic system models. Axioms are given for the designations of logic-differential systems, differential-dynamic systems, and final automations. The logic-differential equations are developed independently of finite difference schemes and can combine the properties of smoothness, completeness, and uniqueness. N.E.N.

N72-25138# Joint Publications Research Service, Arlington, Va.
AUTOMATA BEHAVIOR IN RANDOM MEDIA WITH RESTRICTED LENGTH OF INPUT WORDS c10
E. M. Vavilov and K. L. Kostov *In its* Cyberetics Res. Reported 23 May 1972 p 30-36 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

An automaton which functions in a stationary random medium is considered in which the output variable can acquire two values and the input variables can acquire two other values, gain and loss. It is shown that the length, n, of the input word is limited. The automatons which provide the minimal values of probability of losses are determined. The automatons are graphed in the form of a tree which has exactly n + 1 layers, since the automaton will remain at one of the positions of the (n - 1)th layer. N.E.N.

N72-25139# Joint Publications Research Service, Arlington, Va.
ON ONE METHOD OF INFORMATION OUTPUT IN SPEECH FORM FROM COMPUTERS c08
V. G. Velychko and V. I. Kulya *In its* Cybernetics Res. Reported 23 May 1972 p 37-45 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

Methods for constructing an automated speech output system are described, and details of an arrangement using Dneiper 1 and auxiliary equipment to implement the synthesis are presented. Systems using other computers are also mentioned, and the size of double units and words, the number of magnetic drums, and the time of operation are calculated. N.E.N.

N72-25140# Joint Publications Research Service, Arlington, Va.
A HYPOTHETICAL HEART-LUNGS MODEL
R. V. Belyakov *In its* Cybernetics Res. Reported 23 May 1972 p 46-52 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

A mechanical model of the heart and lungs is described,

including an autoperfusion apparatus for separating air and venous blood. The scheme enriches the blood simultaneously with the autoperfusion, and uses for membranes a hypothetical polymer which is deformed by contact with air and blood. The polymer membranes, in accordian-like structure, are in two blocks for antiphasing. Air moves through the odd interstices and blood through the even. Air in one block is expanded and air in the other block is contracted. Air then flows from the first block to the second while the second is being bathed by blood from a bellows. This causes a reversed deformation of the membranes which in turn reverses the flows. N.E.N.

N72-25141# Joint Publications Research Service, Arlington, Va.
ON THE CHOICE OF AN INDEX FUNCTION FOR LONG-TERM PROGNOSTICATION OF THE DEVELOPMENT OF SCIENCE **c30**
P. B. Vasylyk *In its* Cybernetics Res. Reported 23 May 1972 p 53-64 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

The logistics curve is used to describe those data which are not described by an exponential law. Graphs are presented illustrating the following relationships: quantity of books in large libraries versus time; quantity of scientific discoveries versus time; tonnage of ships versus time (for the last two millennia); historical persons of note versus time (from the 10th century BC to the 16th AD); population growth in Europe; and number of books versus number of people. Hypotheses concerning the population growth and decrease in Europe, especially since the 10th century AD, are mentioned. N.E.N.

N72-25142*# Technology, Inc., San Antonio, Tex.
KOROTKOV SOUND PROCESSOR Patent Application
Donald P. Golden, George W. Hoffler, and Roger A. Wolthuis, inventors (to NASA) Filed 24 May 1972 22 p
(Contract NAS9-7675)
(NASA-Case-MSC-13999-1; US-Patent-Appl-SN-256317) Avail: NTIS HC $3.25 CSCL 06B

A Korotkov sound processor is described which is used in a non-invasive, automatic blood pressure measuring system where the brachial artery is occluded by an inflatable cuff. The Korotkoff sound associated with the systolic event is determined when the ratio of the absolute value of a voltage signal, representing Korotkov sounds, in the range of 18 to 26 Hz to a maximum absolute peak value of the unfiltered signals first equals or exceeds a value of 0.45. The Korotkov sound associated with the diastolic event is determined when a ratio of the voltage signal of the Korotkov sounds in the range of 40 to 60 Hz to the absolute peak value of such signals within a single measurement cycle first falls below a value of 0.17. The processor signals the occurrence of the systolic and diastolic events and these signals can be used to control a recorder to record pressure values for these events. NASA

N72-25143*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
PRELIMINARY IMBLMS SYSTEMS ARRANGEMENT AND CREW CONSTRAINTS, IMBLMS PHASE B-4. APPENDIX 3: DOCUMENTATION FOR SYSTEM DESIGN AND OPERATION Final Project Definition Study
D. S. Hetzel 16 Nov. 1970 425 p refs
(Contract NAS9-10741)
(NASA-CR-115664; GE-70SD5386; Doc-70SD5399) Avail: NTIS HC $23.50 CSCL 05H

The integrated medical behavioral laboratory measurement system is described. The functional arrangements of the consoles, clinical/physiological bay, systems control/behavioral bay, and the analysis bay are discussed along with the restraints on the operator and subject. The design considerations for the clinical, physiological, and behavioral measurements are analyzed. F.O.S.

N72-25144*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
UNIVERSITY ROLE IN ASTRONAUT LIFE SUPPORT SYSTEMS: SPACE POWER SUPPLY SYSTEMS
Lang Y. Chin Washington NASA Jun. 1972 156 p refs
(Grant NGR-22-009-312)
(NASA-CR-2061) Avail: NTIS HC $3.00 CSCL 06K

A brief description is given of the schemes suggested for providing electrical power aboard spacecraft. An attempt was made to list the major advantages and disadvantages of each scheme and to identify the particular areas in which it appears likely further research work may prove fruitful. Special attention was given to those research areas that appear suitable for colleges and university work. Chemical, solar, and nuclear power sources are considered together with the appropriate thermoelectric and turboelectric conversion systems. Author

N72-25145# Human Engineering Labs., Aberdeen Proving Ground, Md.
IMPROVED WEAPON NOISE EXPOSURE CRITERIA
David C. Hodge Feb. 1972 19 p refs
(AD-738135; HEL-TN-1-72) Avail: NTIS CSCL 05/5

The state of the art in noise-exposure criteria is reviewed and it is suggested that such criteria are in need of revision and extension to meet future operational requirements of the Army. Further, existing noise criteria, expressed in terms of decibels of hearing loss, should be restated in terms of predictions about the performance of military personnel after they have been exposed to noise. Such restatement in performance terms will significantly improve communication about the risk of noise exposure to people who are in a position to utilize such information but who generally do not comprehend the notation of decibels of hearing loss. Author (GRA)

N72-25055# Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).
A SIMPLIFIED AND IMPROVED METHOD FOR OPERATIONAL ANTHROPOMETRIC PROGRAMMES
H. J. Grunhofer *In* AGARD Improved and Simplified Methods for the Clin. Evaluation of Aircrew, Part 2 Mar. 1972 8 p (See N72-25048 16-04)
Avail: NTIS HC $6.25

N72-25800*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATED DETECTION OF BACTERIA IN URINE
Albert J. Fleig, Grace L. Picciolo, Emmett W. Chappelle, and Burton N. Kelbaugh *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 188-192 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 06B

N72-25801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HEART SOUND PREPROCESSOR
Wayne T. Chen *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 193-195 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 06B

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-25146* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF HYDROGEN-DEUTERIUM MIXTURES Patent
Harry C. Lord, III, inventor (to NASA) Issued 30 May 1972 4 p Filed 6 Nov. 1970 Supersedes N72-13101 (10 - 04, p 445) Sponsored by NASA

(NASA-Case-NPO-11322; US-Patent-3,666,942;
US-Patent-Appl-SN-87550; US-Patent-Class-250-43.5R;
US-Patent-Class-73-23.1) Avail: US Patent Office CSCL 07B

A hydrogen-deuterium mixture is partially separated by helium carrier gas chromatography to form an effluent which is measured to determine total hydrogen isotopic concentration. The HD component of the effluent is ionized to form HD(+) ions. The HD(+) 1-0 band absorption is then measured with a conventional high resolution infrared detector providing a signal indicative of absolute deuterium concentration (as HD). The H/D ratio is readily determined from the total concentration and deuterium concentration.

Official Gazette of the U.S. Patent Office

N72-25147* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

POLYMERIC VEHICLES AS CARRIERS FOR SULFONIC ACID SALT OF NITROSUBSTITUTED AROMATIC AMINES Patent

Paul M. Sawko, inventor (to NASA) Issued 16 May 1972 3 p Filed 13 Aug. 1970 Supersedes N70-41950 (08 - 24, p 4460)
(NASA-Case-ARC-10325; US-Patent-3,663,464;
US-Patent-Appl-SN-63610; US-Patent-Class-260-2.5FP) Avail: US Patent Office CSCL 07D

An intumescent agent is provided which contains the ammonium salt of 4-nitroaniline-2-sulfonic acid and a polymer of the mercaptan type which may contain disulfide linkages of polyoxyalkylene linkages. The adhesion and char resistance of such compositions can be further improved by the addition of epoxy resins. Official Gazette of the U.S. Patent Office

N72-25148* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SILOXANE CONTAINING EPOXIDE COMPOUNDS Patent

William J. Patterson, inventor (to NASA) Issued 2 May 1972 7 p Filed 27 Jan. 1970 Continuation-in-part of US Patent Appl. SN-715975, filed 26 Mar. 1968
(NASA-Case-MFS-13994-2; US-Patent-3,660,434;
US-Patent-Appl-SN-870689; US-Patent-Class-260-348SC) Avail: US Patent Office CSCL 07C

Siloxane-containing epoxy polymers are prepared by reacting siloxane-containing epoxides with siloxane-containing diamines. Both the epoxide and the diamine reactant are characterized by their capability for inclusion of a controllable number of siloxane groups. The product polymers exhibit a low dielectric constant and other properties favorable to their use for electronic packaging applications. Methods for preparation of the reactant monomers are also disclosed.

Official Gazette of the U.S. Patent Office

N72-25149* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FLAVIN COENZYME ASSAY Patent

Emmett W. Chappelle and Grace L. Picciolo, inventors (to NASA) Issued 2 May 1972 4 p Filed 5 May 1969 Supersedes N69-33349 (07 - 19, p 3523)
(NASA-Case-GSC-10565-1; US-Patent-3,660,240;
US-Patent-Appl-SN-822039; US-Patent-Class-195-103.5R; US-Patent-Class-195-28N; US-Patent-Class-260-211.5) Avail: US Patent Office CSCL 07C

Flavin coenzymes, the active forms of vitamin B2, were assayed by using boiling perchloric acid to rupture bacterial cells, free the flavin from protein, and hydrolyze flavin adenine dinucleotide to flavin mononucleotide. This was reduced with sodium borohydride and palladium chloride and reacted with the enzyme luciferase to produce light with intensity directly proportional to flavin concentration.

Official Gazette of the U.S. Patent Office

N72-25150* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ELECTRICALLY CONDUCTIVE FLUOROCARBON POLYMER Patent

Harold F. Leibecki, inventor (to NASA) Issued 30 May 1972 3 p Filed 22 Jan. 1970 Supersedes N72-20131 (10 - 11, p 1436) Continuation-in-part of abandoned US Patent Appl. SN-631847, filed 17 Apr. 1967
(NASA-Case-XLE-6774-2; US-Patent-3,666,741;
US-Patent-Appl-SN-5114; US-Patent-Class-260-92.1;
US-Patent-Class-117-132; US-Patent-Class-117-161;
US-Patent-Class-260-2.5) Avail: US Patent Office CSCL 07D

Fluorocarbon polymers are impregnated with rhenium or molybdenum by immersion in liquid rhenium hexafluoride or molybdenum hexafluoride. The rhenium and molybdenum fluoride compounds are then hydrolyzed to form conductive oxides. The impregnated polymer is electrically conductive.

Official Gazette of the U.S. Patent Office

N72-25151* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SILPHENYLENESILOXANE POLYMERS HAVING IN-CHAIN PERFLUOROALKYL GROUPS Patent

William J. Patterson and Donald E. Morris, inventors (to NASA) Issued 30 May 1972 4 p Filed 22 Dec. 1970 Supersedes N72-15128 (10 - 06, p 731)
(NASA-Case-MFS-20979; US-Patent-3,666,718;
US-Patent-Appl-SN-100774; US-Patent-Class-260-46.5P; US-Patent-Class-260-18S; US-Patent-Class-260-46.5E; US-Patent-Class-260-46.5G; US-Patent-Class-260-448.2D) Avail: US Patent Office CSCL 07D

Silphenylenesiloxane polymer having in-chain perfluoroalkyl groups is prepared by reacting a disilanol with a diaminosilane. This, when cured, produces a polymeric material resistant to hydrocarbon fuels and stable at elevated temperatures.

Official Gazette of the U.S. Patent Office

N72-25152* McDonnell-Douglas Co., Santa Monica, Calif.

POLYMERS OF PERFLUOROBUTADIENE AND METHOD OF MANUFACTURE Patent

Madeline S. Toy and James M. Newman, inventors (to NASA) Issued 16 May 1972 4 p Filed 19 May 1971 Supersedes N72-201127 (10 - 11, p 1435) Continuation-in-part of US Patent Appl. SN-848325, filed 7 Aug. 1969 Sponsored by NASA
(NASA-Case-NPO-10863-2; US-Patent-3,663,521;
US-Patent-Appl-SN-145026; US-Patent-Class-260-92.1) Avail: US Patent Office CSCL 07D

A polyperfluorobutadiene is described which is a copolymer of perfluoro-1,2- and 1,4-butadiene. One method of initiating the polymerization of the perfluorobutadiene utilizes disopropyl peroxydicarbonate. Official Gazette of the U.S. Patent Office

N72-25153*# Tyco Labs., Inc., Waltham, Mass.

THE ALUMINUM ELECTRODE IN AlCl3-ALKALI-HALIDE MELTS

Gerhard L. Holleck and Jose Giner [1972] 20 p refs
(Contract NAS12-688)
(NASA-CR-126727) Avail: NTIS HC $3.00 CSCL 11F

Passivation phenomena were observed upon cathodic and anodic polarization of the Al electrode in AlCl3-KCl-NaCl melts between 100 and 160 C. They are caused by formation of a solid salt layer at the electrode surface resulting from concentration changes upon current flow. The anodic limiting currents increased with temperature and with decreasing AlCl3 content of the melt. Current voltage curves obtained on a rotating aluminum disk showed a linear relationship between the anodic limiting current and 1/sq root of 2 pi (rps). Upon cathodic polarization dentrite formation occurs at the Al electrode. The activation overvoltage in AlCl3-KCl-NaCl (57.5-12.5-20 mol%) was determined by galvanostatic current step methods. An apparent exchange current density of 270 mA/cm2 at 130 C and a double layer capacity of 40 plus or minus 10 microfarad/cm2 were measured. Author

N72-25154# Dow Chemical Co., Freeport, Tex.
TESTS OF POLYHYDRIC CHEMICALS FOR FOG DISPERSAL Interim Report, Oct. - Nov. 1971
J. M. McDuff, J. L. Dunn, Jr., Z. J. Moore, and E. L. Pendleton
Jan. 1972 60 p
(Contract DOT-FA72WA-2727)
(TOPR-178-1-121) Avail: NTIS HC $5.00

Cooperative fog dispersal trials were conducted with the Foggy Cloud 4 Project team at Arcata/Eureka Airport and in Redwood Valley, California. These trials demonstrated that both the rotating screen impactor and the disc particulator can be used to generate finely divided particulate (50 micron diameter median range) of the high viscosity chemicals used for fog dispersal. Glycerine, diethylene glycol, and tetraethylene glycol were successfully generated into a fine mist using these devices. Three runs were made treating fog with glycerine. Visibility improvement was observed, but not measured, in each run.
Author

N72-25155# Paris Univ., Orsay (France).
EFFECT OF TEMPERATURE AND ENVIRONMENT ON NONRADIATIVE TRANSITIONS IN XANTHINE COLORING MATTER Ph.D. Thesis [EFFET DE LA TEMPERATURE ET DE L'ENVIRONNEMENT SUR LES TRANSITIONS NON RADIATIVES DANSLES COLORANTS XANTHENIQUES]
Monigue Martin 17 Mar. 1970 79 p refs In FRENCH
Avail: NTIS HC $6.00

A study, by spectrofluorometry and flash photolysis, of fluorescence and intersystem passage of internal conversion in two Xanthine colorants was made. One colorant was studied in a basic solution of H2O, D2O ethanol, and glycerol; the other colorant was studied in an acid solution in water. Measurements were made of the variability of the probability of transitions in nonradiatives and the function of temperature from 0 to 50 C according to the nature of the solvant. Transl. by E.H.W.

N72-25156# Paris Univ., Orsay (France).
ON THE PHOTOCHEMISTRY OF SOME AROMATIC COMPOUNDS IN SOLID SOLUTION. 1: PHOTOIONIZATION OF SOLUTE. 2: PHOTOSENSITIVE DISSOCIATION OF SOLVENTS Ph.D. Thesis [SUR LA PHOTOCHIMIE DE QUELQUES COMPOSES AROMATIQUES EN SOLUTION SOLIDE. 1: PHOTOIONISATION DU SOLUTE. 2: DISSOCIATION PHOTOSENSIBILISEE DU SOLVANT]
M. C. Peraudeau [1970] 84 p refs In FRENCH
Avail: NTIS HC $6.25

The photoionization process and the composition of aromatic compounds dissolved in a rigid crystalline vitreous matrix, which undergoes photosensitive dissociation, is examined. Data cover (1) characteristics required for the vitreous matrix, (2) influence of rigid environments on the different processes of relaxation energy and electron excitation, (3) photoionization mechanism of aromatic compounds in solid solutions, and (4) photosensitive dissociation mechanism of the solvents used. Transl. by E.H.W.

N72-25157# Paris Univ. (France). Faculte des Sciences.
CONTRIBUTION OF THE STUDY OF DISPLACEMENT OF THE FIRST VIBRATIONAL LEVEL OF ADSORBED CARBON MONOXIDE ON THE FACE OF (III) TUNGSTEN (INELASTIC DIFFUSION OF VERY SLOW ELECTRONS) Ph.D. Thesis [CONTRIBUTION A L'ETUDE DU DEPLACEMENT DU PREMIER NIVEAU VIBRATIONNEL DE L'OXYDE DE CARBONE ADSORBE SUR LA FACE (III) DU TUNGSTENE (DIFFUSION INELASTIQUE DES ELECTRONS TRES LENTS)]
Francoise Yerouchalmi-Soussaline 18 Feb. 1970 95 p refs In FRENCH
Avail: NTIS HC $6.75

The chemisorption, in an ultravacuum environment, of CO on the surface of tungsten III is discussed. Data cover reflection of very weak electrons, electron interactions with complete gas surfaces, infrared adsorption, inelastic diffusion of very slow electrons, and molecular vibration displacement.
Transl. by E.H.W.

N72-25158*# Gillette Research Inst., Inc., Rockville, Md.
STUDY OF MECHANISM WHICH CAUSES FILM FORMATION ON MERCURY SURFACES
Geoffrey Frohnsdorff and Diane Dunn Mar. 1972 74 p refs
(Contract NAS3-14363)
(NASA-CR-120884) Avail: NTIS HC $5.75 CSCL 07B

The mechanism by which small quantities of dissolved tin, sodium, and lithium lower the rate of evaporation of mercury in vacuum is determined. An apparatus was built in which dilute amalgams could be prepared and studied in an oxygen-free environment before being exposed to oxygen under controlled conditions. The apparatus was able to maintain a pressure of less than 1.3 x 0.000001 N/sqm (10 to the minus 8th power torr) of gases and vapors other than mercury and less than 1.3 x 10 to the minus 8th N/sq m (10 to the minus 10th power torr) partial pressure of oxygen; also, it provided for mechanical sweeping of the liquid metal surfaces in the vacuum environment. The rates of evaporation of pure mercury and of dilute amalgams of tin (52 ppm), sodium (229 ppm), and lithium (165 ppm) were determined at temperature between 25 and 55 C both before and after 70 minute exposures to an approximately 270 N/sq m (2 torr) pressure of oxygen. The rates of evaporation of the pure mercury and the amalgams as first prepared were similar but the rates for the amalgams were reduced by at least 80% at 25 C as a result of the exposure to oxygen. The effect of the oxygen treatment could be completely removed by sweeping the amalgam surfaces. It was concluded that the reduced rates of evaporation resulted from the formation of transparent, insoluble, oxide films on the amalgam surfaces.
Author

N72-25159*# Boeing Co., Seattle, Wash. Aerospace Group.
INVESTIGATION OF THE FEASIBILITY OF DEVELOPING LOW PERMEABILITY POLYMERIC FILMS
J. T. Hoggatt Dec. 1971 90 p refs
(Contract NAS3-13326)
(NASA-CR-120892; ASG-2-5540) Avail: NTIS HC $6.50 CSCL 07D

The feasibility of reducing the gas permeability rate of Mylar and Kapton films without drastically effecting their flexibility characteristics at cryogenic temperatures was considered. This feasibility was established using a concept of diffusion bonding two layers of metallized films together forming a film-metal-film sandwich laminate. The permeability of kapton film to gaseous helium was reduced from a nominal ten = to the minus 9 power cc-mm/sq cm sec. cm Hg to ten to the minus 13 power cc-mm/ sq cm - sec. cm Hg with some values as low as ten to the minus 15 power cc - mm/sq cm m-sec - cm Hg being obtained. Similar reductions occurred in the liquid hydrogen permeability at -252 C. In the course of the program the permeability, flexibility and bond strength of plain, metalized and diffusion bond film were determined at +25 C, -195 C and -252 C. The cryogenic flexibility of Kapton film was reduced slightly due to the metallization process but no additional loss in flexibility resulted from the diffusion bonding process.
Author

N72-25160# National Bureau of Standards, Washington, D.C. Chemical Kinetics Information Center.
CHEMICAL KINETICS IN THE C-O-S AND H-N-O-S SYSTEMS: A BIBLIOGRAPHY, 1899 THROUGH JUNE 1971
Francis Westley Apr. 1972 69 p refs Sponsored in part by Naval Ordnance Systems Command
(NBS-SP-362) Avail: SOD $0.70 as C 13.10:362

A bibliography, a reaction-oriented list of references, is provided for published papers and reports containing rate data for reactions of COS, COS2, CS, CS2, CS3, D2S, H2S, H2S2, HSO2, S, SH, SO, SO2, SO3, SO4, S2, S2O2, S4, S6 and S8 with each other and with CO, CO2, D, D2, H, H2, H2O, N, N2, N2O, N2O5, NO, NO2, NO3, NOS, O, OH, O2, O3, R and RH. Three lists of critical reviews dealing with the above compounds are included.
Author

N72-25161*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW METHODS FOR PREPARING N, N-DIALKYL-TRIFLUOROACETAMIDES
Li-Chen Hsu Washington Jun. 1972 21 p refs
(NASA-TN-D-6836; E-6777) Avail: NTIS HC $3.00 CSCL 07A

The customary preparative methods for N,N-dialkyl-trifluoroacetamides involve the acylation of an amine by trifluoroacetic acid or its derivatives. In this report the synthesis of N,N-dialkyltrifluoroacetamides by reacting trifluoroacetic anhydride or acid with disubstituted formamides and acetamides is discussed. These reactions are interpreted with the aid of gas chromatographic analysis. Different reaction mechanisms are proposed for the reactions of formamides and acetamides with trifluoroacetic anhydride or acid. The use of the proposed reaction mechanisms for the synthesis of other fluorinated compounds is discussed. Author

N72-25162# Eidgenossische Technische Hochschule, Zurich (Switzerland).
DEVELOPMENT OF A GENERAL DESCRIPTIVE MODEL FOR DIFFUSION ADSORPTION REACTIVE SYSTEMS Ph.D. Thesis [ENTWICKLUNG EINES MODELLS ZUR ALLGEMEINEN BESCHREIBUNG VON DIFFUSIONS-ADSORPTIONS-REAKTIONS-SYSTEMEN]
Roland Ott 1971 137 p refs In GERMAN
(Diss-4746) Avail: NTIS HC $9.00

The characteristics of diffusion, adsorption, and reaction type chemical processes are presented. Two experimental methods for determining the diffusion coefficients are described. A numerical analysis of diffusion controlled adsorption processes is explained. Mathematical models are provided to support the theoretical considerations. Transl. by P.N.F.

N72-25163# Eidgenossische Technische Hochschule, Zurich (Switzerland).
GREEN FUNCTIONS AND QUASI-PARTICLES IN QUANTUM CHEMISTRY; STUDIES WITH TWO EXACT SOLVABLE MODELS Ph.D. Thesis [GREENFUNKTIONEN UND QUASITEILCHEN IN DER QUANTENCHEMIE; UNTERSUCHUNGEN ANHAND VON ZWEI EXAKT LOFSBAREN MODELLEN]
Walter Friedrich Muench 1971 189 p refs In GERMAN
(Diss-4705) Avail: NTIS HC $11.50

The structure of the Green function method is outlined and the introduction of quasiparticles into molecular systems of this scheme is analyzed by utilizing qualitative properties of the spectra of molecular electronic Hamiltonian operators of the Born Oppenheimer approximation. Considered are the following two quantum mechanical, multiple particle models: one has two coupled Fermi fields, and the other has a spin of 1/2 that interacts with a Boson field. Transl. by G.G.

N72-25164*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRODUCTION OF PURE METALS Patent Application
Warren H. Philipp, Stanley J. Marsik, and Charles E. Max, inventors (to NASA) Filed 18 Apr. 1972 10 p
(NASA-Case-LEW-10906-1; US-Patent-Appl-SN-254279) Avail: NTIS HC $3.00 CSCL 07D

A process for depositing elements by irradiating liquids is described. Ultra-pure elements are precipitated from aqueous solutions or suspensions of compounds. A solution of a salt of a metal to be prepared is irradiated, and the insoluble reaction product settles out. NASA

N72-25165# Royal Aircraft Establishment, Farnborough (England).
ON THE POLAROGRAPHY OF METHAQUALONE, DORMUTIL AND ETHINAZONE, AOLAN. 5TH REPORT: POLAROGRAPHY OF HETEROCYCLES
P. Pflegel and G. Wagner May 1972 18 p refs Transl. into ENGLISH from Pharmazie (Berlin), v. 22, 1967 p 643-650
(RAE-Lib-Trans-1608; BR29233) Avail: NTIS HC $3.00

The compounds 2-methyl-3-/2-methylphenyl/-3,4-dihydroquinazolinone-(4) (methaqualone, Dormutil) and 2-methyl-3-/2-ethylphenyl/-3,4-dihydroquinazolinone-(4) (ethinazone, aolan) were reduced at a dropping mercury electrode between pH 0 and 8, with the capture of two electrons per molecule. In the range of concentrations to 0.001 m, the reduction leads mainly to the corresponding 1,2,3,4-tetrahydroquinazolinones-(4), and in addition the dimers of these compounds occur at higher concentrations. The mechanism of the electrode reaction is discussed. The possibilities of quantitatively determining the compounds were investigated. Author

N72-25166# National Research Council of Canada, Ottawa (Ontario).
THE CRITICAL SHEAR STRESS OF ALKALI HALIDES DOPED WITH DIVALENT CATIONS. 1: NON-AGGLOMERATED IMPURITY ION-VACANCY PAIRS
W. Frank 1972 20 p refs Transl. into ENGLISH from Phys. Status Solidi (West Germany), v. 29, no. 1, 1968 p 391-402
(NRC-TT-1544) Avail: NTIS HC $3.00

It is shown that in alkali halides containing divalent cations, which form elastic dipoles by associating with cation vacancies, the critical shear stress tau sub 0 is determined by the elastic interactions between these dipoles and the dislocations. Below room temperature tau sub 0 arises from the thermally activated passing of dislocations near dipoles which are located close to the slip planes. Above room temperature the induced Snoek effect of dipoles in the stress fields of dislocations determines tau sub 0. The temperature independent region just above room temperature is continued by a regime in which tau sub 0 decreases rapidly. In this high temperature region the breaking up of dipoles into divalent cations and cation vacancies plays a decisive role in addition to the induced Snoek effect. Author

N72-25167# National Physical Lab., Teddington (England). Div. of Chemical Standards.
COMPARISON OF SOME METHODS FOR THE PREDICTION OF B12 VALUES FOR GAS MIXTURES CONTAINING ONE SIMPLE GAS AND ONE MORE COMPLEX GAS
J. D. Cox Feb. 1972 18 p refs
(NPL-DCS-14) Avail: NTIS HC #3.00

Methods such as the corresponding states method, the Stockmayer's interaction-potential function, and the spherical core Kihara interaction are compared. Potential function methods for prediction of the B-12 (cross term second virial coefficient resulting from interaction between unlike molecules) values for binary gas mixtures are described. The B-12 values predicted by these methods and values obtained by experiment for different gas mixtures are compared and discussed. ESRO

N72-25168# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
COLLISIONAL EFFICIENCY IN VIBRATIONAL EXCITATION OF HF AND DF Research Report, Jul. - Dec. 1971
Jay A. Blauer, Wayne C. Solomon, and T. W. Owens Apr. 1972 57 p refs
(AD-738296; AFRPL-TR-72-15) Avail: NTIS CSCL 07/4

The vibrational excitation of HF and DF and the energy transfer efficiencies for various collision partners were investigated over the temperature and pressure ranges of 1400K to 4100K and 0.1 to 0.3 atm, respectively. The extent of excitation was determined as a function of time by continuously monitoring the infrared emission intensity at 4100 plus or minus 200/cm. Collisional efficiencies of H2O, D2O, NO, O, Cl, Br, and I in relaxing HF and of Cl and F in relaxing DF are reported. Atomic species were obtained by dissociation of larger molecules. All data were obtained behind incident shock waves. The mechanism for relaxation was found to depend greatly upon the collision partner considered. Author (GRA)

N72-25169# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
INVESTIGATION OF THE ABSORPTION OF INFRARED RADIATION BY NITROUS OXIDE FROM 760 TO 2380/CM (13.2 TO 4.2 MICROMETERS) Semiannual Technical Report
Darrell E. Burch, David A. Gryvnak, and John D. Pembrook Dec. 1971 46 p refs
(Contract F19628-69-C-0263; ARPA Order 1366; AF Proj. 5130)
(AD-737839; U-4995; AFCRL-71-0620; SATR-4) Avail: NTIS CSCL 07/4

Experimental data are presented on the absorption by a variety of N2O samples between 760 and 2380/cm. Most of the absorption between 760 and 850/cm is due to extreme wings of lines centered outside the interval. Strengths of the important band systems are given. Curves of transmittance and tables of integrated absorptance and the integrated absorption coefficient provide detailed information on the absorption. The objective of the study was to provide the data required to determine the parameters of all N2O absorption lines that absorb significantly over any atmospheric path of interest.
Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-25170* Virginia Univ., Charlottesville.
ACTIVE MICROWAVE IRISES AND WINDOWS Patent
Robert L. Ramey, Hugh S. Landes, and Eugene A. Manus, inventors (to NASA) Issued 14 Mar. 1972 5 p Filed 18 Aug. 1970 Supersedes N70-42162 (08-24, p 4468) Sponsored by NASA
(NASA-Case-LAR-10513-1; US-Patent-3,649,935;
US-Patent-Appl-SN-64723; US-Patent-Class-333-98R;
US-Patent-Class-333-98P; US-Patent-Class-333-98S;
US-Patent-Class-333-7; US-Patent-Class-333-81R) Avail: US Patent Office CSCL 17B

A waveguide thin film window or an iris fabricated from either a thin film or a conventional plate and mounted transverse to the flow of energy in a waveguide and electrically insulated is described. Diode switching means are provided for selectively disconnecting and connecting the window or iris to the walls of the waveguide.
Official Gazette of the U.S. Patent Office

N72-25171* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EMERGENCY LUNAR COMMUNICATIONS SYSTEM Patent
Otha H. Vaughan and Lee B. Malone, inventors (to NASA) Issued 30 May 1972 7 p Filed 3 Nov. 1970 Supersedes N72-20163 (10-11, p 1440)
(NASA-Case-MFS-21042; US-Patent-3,667,044;
US-Patent-Appl-SN-86417; US-Patent-Class-325-4;
US-Patent-Class-325-114; US-Patent-Class-343-6.5R;
US-Patent-Class-102-34.4) Avail: US Patent Office CSCL 17B

A communication system is reported for emergency use on the moon that includes three transceivers. One of the transceivers is carried by an astronaut and another is positioned at a basecamp. The system also includes a hand held launcher and rocket vehicle that is utilized by the astronaut to launch a third relay transceiver in an upward trajectory above the lunar surface. The relay transceiver is mounted in the rocket vehicle and functions to rely voice communications between the two transceivers located on the lunar surface.
Official Gazette of the U.S. Patent Office

N72-25172* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLEXIBLE COMPUTER ACCESSED TELEMETRY Patent
Richard A. Easton and Edward E. Hilbert, inventors (to NASA) Issued 23 May 1972 14 p Filed 19 Feb. 1971 Supersedes N71-34160 (09 - 21, p 3395) Sponsored by NASA
(NASA-Case-NPO-11358; US-Patent-3,665,417;
US-Patent-Appl-SN-116786; US-Patent-Class-340-172-5;
US-Patent-Class-179-15BV) Avail: US Patent Office CSCL 17B

A telemetry system based on flexible, computer-accessed circuits is described. Sensors and digital data sources are sampled in a programmed format with various groups of samples taken at different rates. Each programmed sample may be processed for transmission in a specified way by including an operation code. A particular format may be started, stopped, and altered by ground station commands.
P.N.F.

N72-25173* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOCATION IDENTIFICATION SYSTEM Patent
Robert L. Trent, inventor (to NASA) 23 May 1972 19 p Filed 13 Jul. 1970 Supersedes N70-36078 (08 - 19, p 3502)
(NASA-Case-ERC-10324; US-Patent-3,665,313;
US-Patent-Appl-SN-54270; US-Patent-Class-325-55;
US-Patent-Class-325-38; US-Patent-Class-325-51;
US-Patent-Class-325-58; US-Patent-Class-325-64;
US-Patent-Class-325-141; US-Patent-Class-325-302;
US-Patent-Class-325-325; US-Patent-Class-178-69.5;
US-Patent-Class-340-167) Avail: US Patent Office CSCL 17B

A location identification system for identifying a particular ground location from among a plurality of ground locations is reported. Each ground location includes a transmitter that transmits a continuous tone signal when the transmitter is activated. Each transmitter also includes a binary encoder for encoding the continuous tone signal at spaced intervals. Each binary code uniquely identifies the particular transmitter with which it is associated. An aircraft flying above ground locations carries a receiver for receiving the continuous tone signal transmitted by an activated transmitter, and a decoder for decoding the binary encoded portion of the signal. A display device is provided for displaying the identity of the ground location determined as a result of decoding the encoded portion of the signal.
Official Gazette of the U.S. Patent Office

N72-25174* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTI-PURPOSE ANTENNA EMPLOYING DISH REFLECTOR WITH PLURAL COAXIAL HORN FEEDS Patent
Kenneth E. Woo, inventor (to NASA) Issued 23 May 1972 6 p Filed 12 May 1970 Supersedes N72-21155 (10 - 12, p 1574) Sponsored by NASA
(NASA-Case-NPO-11264; US-Patent-3,665,481;
US-Patent-Appl-SN-36531; US-Patent-Class-343-762;
US-Patent-Class-343-777; US-Patent-Class-343-779;
US-Patent-Class-343-786; US-Patent-Class-343-853) Avail: US Patent Office CSCL 17B

A microwave antenna useful on a spacecraft, which utilizes a single dish reflector and single coaxial horn structure to transmit at two frequencies is described, receiving signals at a third frequency. The horn structure includes a coaxial waveguide with an inner pipe for transmitting X-band waves, an intermediate pipe, surrounding the inner pipe for transmitting S-band waves, and an outer pipe surrounding the intermediate pipe for receiving S-band tracking signals. An outer horn flares for the outer pipe and an inner horn flares from the inner pipe to efficiently illuminate the dish reflector at both X and S bands.
Official Gazette of the U.S. Patent Office

N72-25175 British Broadcasting Corp., Kingswood (England). Engineering Div.
PULSE CODE MODULATION OF VIDEO SIGNALS: SUBJECTIVE EFFECT OF RANDOM DIGIT ERRORS
V. G. Devereux May 1972 10 p refs
(BBC-1972/14) Avail: BBC, Kingswood Warren, Tadsworth,

Surrey, England

Tests performed to establish the maximum allowable error rate in a p.c.m. system handling PAL color and monochrome 625-line television signals are described. Both random single-digit errors and burst errors were examined. The tests included an investigation of a system for concealing errors based on the use of parity bits. The results showed that, with no error concealment in use, the picture impairment was negligible if the error rate was no greater than 1 in 10 to the 7th power, similar results being obtained for both single-digit and burst errors; with error concealment in use, the error rate should not be greater than 1 in 10,000 for single-digit errors or 1 in 100,000 for burst errors having a duration of less than 1 microsecond. Author

N72-25176 British Broadcasting Corp., Kingswood (England). Engineering Div.

THE PERFORMANCE OF A NON-SYNCHRONOUS AM DETECTOR DESIGNED TO REMOVE ASYMMETRIC-SIDEBAND DISTORTION

N. H. C. Gilchrist May 1972 7 p refs

(BBC-1972/13) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Measurements of the harmonic distortion of a sinusoidally modulated carrier were made using envelope and asymmetric side band detectors. In order to check the functioning of the detector, both double sideband and single sideband amplitude modulated signals were used. The single sideband represented the extreme case of sideband asymmetry. Various modulation depths were used and the results of the harmonic distortion tests using a modulation depth of 90 percent are shown. All results showed the same basic pattern in that both types of detector performed very similarly on double side band, but the envelope detector gave very severe harmonic distortion on single sideband signals. Author

N72-25177 Northeastern Univ., Boston, Mass.

A METHOD OF SYNTHESIZING THE FIELDS OF A FEED FOR A SPHERICAL REFLECTOR Ph.D. Thesis

Leon Joseph Ricardi 1969 157 p

Avail: Univ. Microfilms Order No. 71-25765

The present day use of spherical reflectors as a microwave antenna can be attributed almost entirely to the wide-angle scanning properties of the device and the ability to design a correcting feed which will reduce the inherent spherical aberration present. A spherical wave expansion is used to synthesize the fields on the surface of a sphere enclosing the feed. This latter surface, a sphere coincident with the spherical reflector and the desired illumination distribution at the surface of the reflector identify a boundary value problem which is solved using a spherical wave solution to Maxwell's Equations. The synthesized fields obtained by this method are compared with those focal region fields that are produced by a plane wave incident on the spherical reflector. It is shown that the difference in these fields and the computational efficiency of the synthesis procedure favor the use of the synthesized fields in the design of a correcting feed. Dissert. Abstr.

N72-25178 Pittsburgh Univ., Pa.

FULL WAVE SOLUTION FOR THE TRANSMISSION OF ULF AND ELF WAVES THROUGH THE IONOSPHERE (PARTS 1-3) Ph.D. Thesis

D. Lynn Shaeffer 1971 244 p

Avail: Univ. Microfilms Order No. 71-23951

Full wave solutions have been found for plane wave and localized disturbances in the ULF (micropulsation) and ELF frequency ranges. Slow and fast wave disturbances incident at 5000 km. altitude at the frequencies 100, 3.0, 1/3, and 1/300 cps. were analyzed. A model ionosphere developed from existing rocket and satellite data for conditions of midday and midlatitude at sunspot minimum was used in the calculations. The cold plasma dispersion relation was written conveniently in terms of the localized disturbance factor and the ionospheric conductivity tensor elements. The localized disturbances were found to produce large vertical electric fields in the neutral atmosphere for the incident slow waves in the micropulsation range and the incident fast wave at 100 cps. Dissert. Abstr.

N72-25179*# IIT Research Inst., Chicago, Ill.

FIVE YEAR MAGNETIC TAPE FOR UNATTENDED SATELLITE TAPE RECORDERS Final Report

G. S. L. Benn and K. Gutfreund Feb. 1972 95 p refs

(Contract NAS5-21623; IITRI Proj. E6205)

(NASA-CR-122402) Avail: NTIS HC $6.75 CSCL 14C

The development and fabrication of a quantity of long life magnetic tape with properties selected specifically for unattended operation in spacecraft tape recorders was studied. A detailed analytical consideration of various binder systems was undertaken. This included the chemical aspects of the binders, cohesion and adhesion effects, stability and the mechanical and physical properties. The ability to form free films of these polymers and their combination with various oxide loadings and other additives allowed a rapid selection of four polymer candidates for a five year magnetic tape. Samples were evaluated under actual running conditions which included physical, magnetic, and extensive life testing. These sample tapes withstood 50,000 bidirectional tape passes under fairly harsh operating conditions. Author

N72-25180*# Ohio State Univ., Columbus. ElectroScience Lab.

A 15.3 GHz SATELLITE-TO-GROUND DIVERSITY PROPAGATION EXPERIMENT USING A TERMINAL SEPARATION OF 4 KILOMETERS

K. R. Grimm and D. B. Hodge Dec. 1971 80 p refs

(Grant NGR-36-008-080)

(NASA-CR-122395; TR-2374-7) Avail: NTIS HC $6.00 CSCL 17B

The performance of a path diversity satellite-to-ground millimeter wave link with two ground terminals separated by 4 km is discussed. At this separation distance the duration of fades below 6 dB was decreased by at least a factor of 10 when using path diversity and the cumulative crosscorrelation between the attenuations observed at the two terminals during rain events was approximately 0.45. Narrow beam radiometers directed along the propagation paths were also utilized to relate the path radiometric temperature to the path attenuation. An analysis of downlink propagation data for generating diversity link performance statistics is included. Author

N72-25181*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STDN NETWORK OPERATIONS PROCEDURE FOR APOLLO RANGE INSTRUMENTATION AIRCRAFT, REVISION 1

Alan R. Vette and W. A. Pfeiffer Feb. 1972 197 p Revised Supersedes MSFN-502.10

(NASA-TM-X-68825; STDN-502.10-Rev-1) Avail: NTIS HC $12.00 CSCL 09F

The Apollo range instrumentation aircraft (ARIA) fleet which consists of four EC-135N aircraft used for Apollo communication support is discussed. The ARIA aircraft are used to provide coverage of lunar missions, earth orbit missions, command module/service module separation to spacecraft landing, and assist in recovery operations. Descriptions of ARIA aircraft, capabilities, and instrumentation are included. F.O.S.

N72-25182*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PRE-EMPHASIS DETERMINATION FOR AN S-BAND CONSTANT BANDWIDTH FM/FM STATION

G. R. Wallace and W. E. Salter (Sperry Rand Corp., Huntsville, Ala.) 10 Mar. 1972 22 p refs

(NASA-TM-X-64648) Avail: NTIS HC $3.25 CSCL 17B

Pre-emphasis schedules are given for 11 constant-bandwidth FM subcarriers modulating an S band transmitter at three receiver signal to noise ratios (i.e., 9, 15, and 25 dB). The

criterion for establishing these pre-emphasis curves is the achievement, at various receiver intermediate frequency signal to noise ratios, of equal receiver output signal to noise ratios for all channels. It is realized that these curves may not be the optimum pre-emphasis curves based on overall efficiency or maximum utilization of the allotted spectrum, but they are near-optimum for data with channels which require equal output signal to noise ratios, such as spectral densities. The empirically derived results are compared with a simplified, analytically derived schedule and the primary differences are explained. The S band pre-emphasis schedule differs from the lower frequency VHF case. Since most proportional bandwidth and constant bandwidth systems use ground based recorders and some use flight recorders (as the Saturn systems did on VHF proportional bandwidth telemetry), the effects of these recorders are discussed and a modified pre-emphasis schedule is presented showing the results of this study phase. Author

N72-25183*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
POSTFLIGHT ANALYSIS OF THE EVCS-LM COMMUNICATIONS LINK FOR THE APOLLO 15 MISSION
C. L. Royston, Jr. and D. S. Eggers Jan. 1972 40 p refs
(NASA-TM-X-68426; MSC-05161-Suppl-6) Avail: NTIS HC $4.00 CSCL 17B

Data from the Apollo 15 mission were used to compare the actual performance of the EVCS to LM communications link with the preflight performance predictions. Based on the results of the analysis, the following conclusions were made: (1) The radio transmission loss data show good correlation with predictions during periods when the radio line of sight was obscured. (2) The technique of predicting shadow losses due to obstacles in the radio line of sight provides a good estimate of the actual shadowing loss. (3) When the transmitter was on an upslope, the radio transmission loss approached the free space loss values as the line of sight to the LM was regained. D.L.G.

N72-25184*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TELEVISION MULTIPLEXING SYSTEM Patent Application
Lorenz G. Simpkins, inventor (to NASA) Filed 5 May 1972 17 p
(NASA-Case-KSC-10654-1; US-Patent-Appl-SN-250766) Avail: NTIS HC $3.00 CSCL 17B

A television multiplexing system which includes a circuit that inserts a digital coded sync signal and a digital code into a video signal for identifying the channel from which the video signal was generated so that many signals can be sent over a single hard-line is described. The digital sync signal and the digital coded signals are generated by a single crystal controlled clock so that they are always in synchronism with each other. In demultiplexing the signals, so as to feed the video signal to a proper recording channel, the sync signals are utilized for shifting the digital coded signals into a shift register and the shift register, in turn, activates a decoder according to the code stored in the shift register for selecting the proper recording disc or receiver for storing the video signal. NASA

N72-25185# Joint Publications Research Service, Arlington, Va.
RADAR THEORY AND PRACTICE
A. G. Saybel 1 Jun. 1972 299 p refs Transl. into ENGLISH from Teoriya i Tekhnika Radiolokatsii, Moscow, 1971
(JPRS-56143) Avail: NTIS HC $17.00

A collection of topics devoted to problems of improving the efficiency of primary and secondary processing systems with the application of signal quantization is presented. Analysis of some new methods of measuring radar signal parameters, and statistical approaches to systems for the selection of moving targets with interperiod compensation are discussed. Author

N72-25186*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: COMMUNICATIONS SYSTEM FLIGHT EVALUATION AND VERIFICATION
Don Travis and Charles L. Royston, Jr. Washington Jun. 1972 20 p
(NASA-TN-D-6852; MSC-S-322) Avail: NTIS HC $3.00 CSCL 17B

Flight tests of the synergetic operation of the spacecraft and earth based communications equipment were accomplished during Apollo missions AS-202 through Apollo 12. The primary goals of these tests were to verify that the communications system would adequately support lunar landing missions and to establish the inflight communications system performance characteristics. To attain these goals, a communications system flight verification and evaluation team was established. The concept of the team operations, the evolution of the evaluation processes, synopses of the team activities associated with each mission, and major conclusions and recommendations resulting from the performance evaluation are represented. Author

N72-25187*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: VERY HIGH FREQUENCY RANGING SYSTEM
W. C. Panter and Paul W. Shores Washington Jun. 1972 16 p
(NASA-TN-D-6851; MSC-S-320) Avail: NTIS HC $3.00 CSCL 17B

The history of the Apollo very-high-frequency ranging system development program is presented from the program-planning stage through the final-test and flight-evaluation stages. Block diagrams of the equipment are presented, and a description of the theory of operation is outlined. A sample of the distribution of errors measured in the aircraft-flight test program is included. The report is concluded with guidelines or recommendations for the management of development programs having the same general constraints. Author

N72-25188# Maryland Univ., College Park.
TEXTURE DESCRIPTORS USING NEIGHBORHOOD INFORMATION
E. S. Deutsch and N. J. Belkap Apr. 1972 51 p refs
(Grant NSF GJ-32258X)
(TR-184) Avail: NTIS HC $4.75

A method aimed at obtaining descriptors of textural scenes is described. It is based upon the spatial relationship between grey levels at TV picture points neighboring one another. Neighborhoods of various sizes are used. This results in the generation of a small set of 2 x 2 matrices which can then be used to describe the texture. Author

N72-25189# Joint Publications Research Service, Arlington, Va.
BIOLOGICAL TELEMETRY
V. V. Parin 6 Mar. 1972 279 p refs Transl. into ENGLISH from Biologicheskaya Telemetriya, Moscow, 1971
(JPRS-55354) Avail: NTIS HC $16.00

The development of methods and devices for telemetric data acquisition applied to various biological processes in an animate organism are discussed. Various biotelemetric systems are described and the criteria for evaluating them are presented. Specific applications in the fields of labor, sports, clinical research, and space biology are described. Author

N72-25190*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERFORMANCE OF CONVOLUTION CODING CONCATENATED WITH MFSK MODULATION IN A GAUSSIAN CHANNEL
A. K. Choudhury Dec. 1971 32 p refs
(NASA-TM-X-65905; X-751-71-513) Avail: NTIS HC $3.75 CSCL 17B

The improvement in db due to concatenation over conventional M-ary coding is studied to reduce the probability of a bit error and to increase the available bit rate for the same

system parameters of error rate, transmitter power, and range. The results of calculations for orthogonal modulation with noncoherent detection and Q-level correlator quantization are presented. It is shown that the correlator outputs are quantized to one of the Q levels, and the receiver output is a vector consisting of a list of the M correlator quantum levels. The channel has Q(M) possible outputs and M possible inputs. Optimum output is approached by increasing fine quantization
F.O.S.

N72-25191*# Boston Univ., Mass. Dept. of Biol.
BIO-MEDICAL TELEMETRY: SENSING AND TRANSMITTING BIOLOGICAL INFORMATION FROM ANIMALS TO MAN
Stuart Mackay 1971 22 p refs Presented at Symp. on Biotelemetry, Pretoria, 1971
(Grant NGR-22-004-024)
(NASA-CR-127047; Biotel-S-57) Avail: NTIS HC $3.25 CSCL 09F

The application of small radio transmitters for monitoring biological activity in animals and humans is discussed. The microminiaturization of the electronic transmitters makes it possible for them to be swallowed and to operate within the body with no external connections. The small size also makes it possible for the transmitters to be surgically implanted or carried externally to monitor specific bodily functions. The use of satellites to monitor the activity of birds and animals carrying small transmitters is described. Photographs of birds, fish, and reptiles which were equipped with miniature electronic monitors are provided.
P.N.F.

N72-25192*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TELECOMMUNICATIONS SYSTEM DESIGN FOR THE MARINER MARS 1971 SPACECRAFT
Francis J. Taylor, comp. and Glenn W. Garrison, comp. 1 May 1972 39 p
(Contract NAS7-100)
(NASA-CR-126968; JPL-TM-33-535) Avail: NTIS HC $4.00 CSCL 17B

The configuration of the Mariner Mars 1971 spacecraft telecommunications system is detailed, with particular attention to modifications performed to accommodate the orbital mission. The analysis and planning for launching are also discussed.
Author

N72-25193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FURLABLE SPACECRAFT ANTENNA DEVELOPMENT Interim Report
R. E. Oliver and A. H. Wilson 15 Apr. 1972 44 p refs
(Contract NAS7-100)
(NASA-CR-126966; JPL-TM-33-537) Avail: NTIS HC $4.25 CSCL 17B

The development of large furlable spacecraft antennas using conical main reflectors is described. Two basic antenna configurations which utilize conical main reflectors have been conceived and are under development. In the conical-Gregorian configuration each ray experiences two reflections in traveling from the feed center to the aperture plane. In the Quadreflex (four reflection) configuration, each ray experiences four reflections, one at each of two subreflector surfaces and two at the main conical reflector surface. The RF gain measurements obtained from 6-ft and 30-in. models of the conical-Gregorian and Quadreflex concepts respectively were sufficiently encouraging to warrant further development of the concepts.
Author

N72-25194*# Wolf Research and Development Corp., Riverdale, Md. Space Systems Dept.
ANTENNA CONTROL SYSTEM
Feb. 1971 275 p
(Contract NAS5-9756-192)
(NASA-CR-122417) Avail: NTIS HC $15.75 CSCL 09E

The objective of the antenna control system is to utilize the analysis and software developed for the simulated 40 foot antenna system to produce a unified software package providing complete computer control of the 40 foot antenna. The control system comprises a position programmer, scan generator and a digital controller.
Author

N72-25195# Weapons Research Establishment, Salisbury (Australia).
AN ASSESSMENT OF THE INFORMATION RECOVERED FROM THE SATELLITE WRESAT
A. P. Clarke Oct. 1971 16 p refs
(WRE-TN-516-(T)) Avail: NTIS HC $3.00

The transmission, recording and processing of the information telemetred from the satellite WRESAT are discussed. An assessment is then made of the quantity and quality of the information recovered from the records.
Author

N72-25196# Lockheed Missiles and Space Co., Palo Alto, Calif.
ACCURACY AND RESOLUTION IN DETERMINING ANGULAR TARGET COORDINATES
V. V. Grigorin-Riabov, ed. [1970] 16 p Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 240-262
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The accuracy and resolution of a radar station for measuring angular target coordinates are discussed. Problems analyzed include: uncertainty function in the angular coordinates and target resolution; uncertainty function for the range, and one angular coordinate; and accuracy of angular coordinate measurements. Examples of using the developed formulas to estimate the accuracy are included.
F.O.S.

N72-25197# Lockheed Missiles and Space Co., Palo Alto, Calif.
MULTICHANNEL RADAR STATIONS
V. V. Grigorin-Riabov, ed. [1970] 29 p Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Sovetskoe Radio Press, Moscow, 1970 p 426-470
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The application of multichannel radar units to solve radar problems which are not within the scope of single channel systems is discussed. The characteristics of multichannel frequency radars and multichannel space radars are described. The active elements and construction of equipment used by ground radar stations for multichannel radar are illustrated. Mathematical models are included to support the theoretical considerations. It is proven that the reliability of a multichannel radar system will be higher than for a single beam system.
P.N.F.

N72-25198# Radio and Space Research Station, Slough (England).
RADIO AND SPACE RESEARCH, 1968 - 1970
J. A. Saxton 1971 63 p refs
(NP-19177) Avail: NTIS; HMSO 80p; PHI $3.55

Work carried out during 1968-1970 includes: the upper ionosphere (top-side sounding, the effect of neutral winds and electric fields in the F region, fading of VHF and UHF signals from geostationary satellites, incoherent ionospheric scatter, theoretical studies of the magnetosphere, investigation of the field strength produced by a distant HF transmitter, study of ionograms obtained at oblique incidence, application of data from earth satellites to F-region mapping, improvements in ionospheric predictions for HF communications, and effects of directional fluctuations on the gain of large aerials at high frequencies), solar physics, and related phenomena in interplanetary space.
Author (NSA)

N72-25199# Innsbruck Univ. (Austria). Electronics Lab.
FIELD STRUCTURE OF AN ELECTROMAGNETIC WAVE-GUIDE AND MECHANISM OF ITS ENTERING A DISSIPATIVE MEDIUM
Erich Berloffa 20 Oct. 1971 29 p refs
(Contract F44620-71-C-0071; AF Proj. 4600)
(AD-737849; AFCRL-71-0610; SR-3) Avail: NTIS CSCL 20/14

The phenomenon of local periods of antenna receiving voltage was observed by recording a transmitter which is located above ground, 30 km away from the point of reception. An adequate theory had to be developed for describing these periods. In the present report, examinations were based on W. O. Schumann's equations (1): time being eliminated, thus yielding a representation of maximum field strengths of elliptically polarized electromagnetic waves showing only a local dependence. A subsequent expansion of the field strength function in Fourier series helps to explain the result. Author (GRA)

N72-25200# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A SIMULATION FACILITY FOR COMMUNICATION SYSTEMS
Dale A. McNeill 27 Dec. 1971 29 p refs
(Contract F19628-70-C-0230; AF Proj. 1508A)
(AD-738297; TR-489; ESD-TR-71-324) Avail: NTIS CSCL 17/2

A simulation facility, consisting of a small general-purpose computer, associated peripherals, and extensive software, has been developed for analyzing communication systems. Presently, the facility is being used to develop an all digital Sanguine receiver and to gather performance statistics on the receiver. The facility and the simulated Sanguine transmitter and transmission channel necessary for operating the receiver are described. Author (GRA)

N72-25201# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A THEORY FOR OPTIMAL MTI DIGITAL SIGNAL PROCESSING. PART 1: RECEIVER SYNTHESIS
Robert J. McAulay 22 Feb. 1972 68 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-738298; TN-1972-14-Pt-1; ESD-TR-72-55-Pt-1) Avail: NTIS CSCL 17/9

A classical problem in radar theory is the detection of moving targets in a ground clutter plus receiver noise background. Improvements in clutter rejection have recently been made by replacing analog MTI processors by their digital equivalents as this eliminates many of the problems associated with the maintenance of the analog hardware. In an attempt to determine the ultimate improvements possible using this new technology, the MTI problem was formulated as a classical detection problem and solved using the generalized likelihood ratio test. By manipulating the likelihood ratio, the receiver could be interpreted as a clutter filter in cascade with a Doppler filter bank. The performance of the optimum receiver was evaluated in terms of the output signal-to-interference ratio and compared with well-known MTI processors. It was shown that near-optimum performance can be obtained using a sliding weighted Discrete Fourier Transform (DFT). Author (GRA)

N72-25202# Microphase Corp., Cos Cob, Conn. Systems Div.
MIL SAT COM PHASED-ARRAY CONTROL Final Technical Report, Jan. - Sep. 1971
Wayne Matchett Jan. 1972 110 p refs
(Contract F30602-71-C-0152)
(AD-738303; RADC-TR-71-306; Rept-8107-F) Avail: NTIS CSCL 17/2

The report presents the results of a seven-month study and investigation of techniques for the control of phased-array antenna to be used in a ground terminal of a TDMA satellite communications system. A control subsystem was designed that uses a hard-wired high-speed digital processor to control a 576-element array. The beam-steering section of the processor allows a beam redirect time of less than 2 us. The report discusses various array control techniques and describes a design based on the optimum techniques found. The design was simulated on a computer to study the effects of various quantization errors. Author (GRA)

N72-25203# Raytheon Co., Sudbury, Mass.
POLAR FOX 2: EXPERIMENTAL PHASE Semiannual Technical Report no. 1
Lois W. Campbell, Alan H. Katz, and Delbert E. Patton Griffiss AFB, N. Y. RADC 15 Dec. 1971 81 p ref
(Contract F30602-71-C-0214; ARPA Order 1765)
(AD-738305; ER71-4457; RADC-TR-72-21; SATR-1) Avail: NTIS CSCL 17/9

The report describes the Polar Fox II HF backscatter system built by Raytheon Company. This system will be used to collect data relating to the effects of auroral clutter on a HF radar system. The Polar Fox II System consists of a transmitter-receiver site co-located north of Caribou, Maine, and three remote beacon sites; one in Thule and in Narssarssuaq, Greenland, and the other in Keflavik, Iceland. The receiver-processors are described along with measurements of system performance. Also discussed is the co-located transmitter site and the transmitter and receiver antenna arrays. The processing and displays to be used in the analysis of the data are also presented. Author (GRA)

N72-25204# Human Engineering Labs., Aberdeen Proving Ground, Md.
STUDIES LEADING TO STANDARDIZATION OF RADAR SYMBOLOGY. 3: DISCRIMINATION IN MIXED DISPLAYS, CATHODE RAY TUBE PRESENTATION
C. Jane Davis Dec. 1971 105 p refs
(AD-738132; HEL-TM-27-71) Avail: NTIS CSCL 05/8

The report covers continued experiments toward standardization of radar symbology. Ten code complexes previously used in paper and pencil tests have been replicated on a cathode ray tube (CRT). Each code consists of five geometric symbols representative of a display vocabulary. Thirty subjects repeatedly selected individual symbols from a mixed display. Performance was measured in terms of errors and time to locate. The best and worst codes confirmed paper and pencil experiments previously reported. Times and errors were consistently greater on the CRT. Symbol characteristics contributing to reduced efficiency are analyzed and tentative rules for CRT symbols are presented. Author (GRA)

N72-25205# Illinois Univ., Urbana.
WIDE-BAND DIPOLE ANTENNA WITH HIGH DIRECTIVITY OF SHAPED RADIATION PATTERN
Paul E. Mayes 2 Feb. 1971 7 p
(Grant NSF GK 2120)
(PB-206688) Avail: NTIS HC $3.00 CSCL 09E

An invention is described that pertains to a method of obtaining an increase in gain for conformity to some shaped pattern from an antenna of fixed maximum dimension while keeping under control the deleterious effects usually met in superdirective antennas. Author (GRA)

N72-25756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO WAVE PROPAGATION EXPERIMENTS TO PROBE THE IONOSPHERE
P. E. Schmid *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 3-9 refs (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20N

N72-25772*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
Ku-BAND HIGH GAIN ANTENNA
Leonard F. Deerkoski *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 74-78 (See N72-25755

16-30)
Avail: NTIS HC $3.00 CSCL 17B

N72-25775*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TELEMETRY REMOTE MODULES
J. R. Silverman *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 87-89 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09F

N72-25778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MILLIMETER WAVE PROPAGATION MEASUREMENTS USING THE ATS 5 SATELLI E
Louis J. Ippolito *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 100-102 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20N

N72-25783*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ADAPTIVE NARROW BAND FREQUENCY MODULATION VOICE COMMUNICATION SYSTEM
Sheldon Wishna *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 119-121 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

N72-25785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF FM-TV THRESHOLD REDUCTION INVESTIGATION FOR THE ATS F TRUST EXPERIMENT
James P. Brown *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 126-128 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

N72-25793*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STADAN ANTENNA GAIN CALIBRATION USING RADIO STARS
Ralph E. Taylor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 156-158 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

N72-25794*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER CONTROLLED ANTENNA SYSTEM
Nicholas A. Raumann *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 159-162 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17I

N72-25795*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DICHROIC SUBREFLECTOR FOR ROSMAN 2
Julius A. Kaiser *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 163-166 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

N72-25796*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNAL COHERENCE STUDIES IN MULTIAPERTURE ARRAYS
Leonard F. Deerkoski *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 167-170 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

N72-25797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NAS-PAK LOGIC SYSTEM
James Billingsley *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 171-180 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09F

N72-25063*# Smithsonian Institution, Washington, D.C.
USE OF THE DOPPLER TECHNIQUE TO TRACK FREE ROAMING ANIMALS FROM SATELLITES
James C. Maxwell *In* NASA, Washington Animal Orientation and Navigation 1972 p 7-17 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 09F

N72-25064*# Sensory Systems Lab., Tucson, Ariz.
LONG RANGE RADIO TRACKING OF SEA TURTLES AND POLAR BEAR: INSTRUMENTATION AND PRELIMINARY RESULTS
Howard A. Baldwin (Ariz. Univ., Tucson) *In* NASA, Washington Animal Orientation and Navigation 1972 p 19-37 refs (See N72-25062 16-04)
(Grant NGR-03-041-001; Contract Nonr-4315(00))
Avail: NTIS; SOD $5.75 CSCL 09F

N72-25065*# Illinois Natural History Survey, Urbana.
LONG DISTANCE TRACKING OF BIRDS
William W. Cochran *In* NASA, Washington Animal Orientation and Navigation 1972 p 39-59 refs (See N72-25062 16-04)
(Grants NSF GB-3155; NSF GB-6680)
Avail: NTIS; SOD $5.75 CSCL 09F

N72-25068*# Smithsonian Institution, Washington, D.C.
SATELLITE AND GROUND RADIOTRACKING OF ELK
Frank C. Craighead, Jr., John J. Craighead, Charles E. Cote, and Helmut K. Buechner *In* NASA, Washington Animal Orientation and Navigation 1972 p 99-111 refs (See N72-25062 16-04)
(Contract NASw-1983)
Avail: NTIS CSCL 09F

N72-25069*# State Univ. of New York at Buffalo.
TRACKING RADAR STUDIES OF BIRD MIGRATION
Timothy C. Williams, Janet M. Williams, John M. Teal (Woods Hole Oceanographic Institution), and John W. Kanwisher (Woods Hole Oceanographic Institution) *In* NASA, Washington Animal Orientation and Navigation 1972 p 115-128 refs (See N72-25062 16-04)
(Grants NSF GZ-259; NSF gb-13246)
Avail: NTIS; SOD $5.75 CSCL 17I

N72-25071*# Durham Univ. (England).
INFORMATION ON BIRD NAVIGATION OBTAINED BY BRITISH LONG RANGE RADARS
Peter R. Evans *In* NASA, Washington Animal Orientation and Navigation 1972 p 139-149 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 17I

N72-25072*# Basel Univ. (Switzerland).
METHODS OF QUANTITATIVE AND QUALITATIVE ANALYSIS OF BIRD MIGRATION WITH A TRACKING RADAR
Bruno Bruderer and Peter Steidinger (Zurich Univ.) *In* NASA, Washington Animal Orientation and Navigation 1972 p 151-167 refs (See N72-25062 16-04)
Avail: NTIS; SOD $5.75 CSCL 17I

N72-25365*# National Severe Storms Lab., Norman, Okla.
COMMENTS ON DOPPLER RADAR APPLICATIONS
Edwin Kessler *In* NAS-NRC Atmospheric Exploration by

Remote Probes, Vol. 2 Jan. 1969 p 287-289 (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 17I

N72-25366*# McGill Univ., Montreal (Quebec).
COMMENTS ON HIGH POWER HIGH RESOLUTION RADARS
J. S. Marshall *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 291-293 (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 17I

N72-25367*# Stanford Univ., Calif. Electronics Labs.
A REVIEW OF TRANSHORIZON PROPAGATION AS A POSSIBLE TOOL FOR REMOTE PROBING OF THE ATMOSPHERE
Donald C. Cox *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 295-336 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20N

N72-25369*# Hughes Aircraft Co., Culver City, Calif.
THEORETICAL INTERPRETATIONS OF SCATTER PROPAGATION
Albert D. Wheelon *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 359-365 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20N

N72-25237# European Space Operations Center, Darmstadt (West Germany).
DATA ACQUISITION AND PRESENTATION FOR SPACECRAFT CONTROL
B. D. Brown *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 38-44 (See N72-25233 16-08)
Avail: NTIS HC $6.50

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-25206* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
BUFFERED ANALOG CONVERTER Patent
Kenneth F. Bower, inventor (to NASA) Issued 7 Mar. 1972 5 p Filed 3 Apr. 1970 Supersedes N70-35566 (08 - 19, p 3507)
(NASA-Case-KSC-10397; US-Patent-3,648,275; US-Patent-Appl-SN-25488; US-Patent-Class-340-347DA; US-Patent-Class-235-154) Avail: US Patent Office CSCL 09B

A converter for converting a binary digital code into an analog representation is described. The converter includes a timing system which is operated by a clock signal to produce a synchronized timing pulse. The digital information is fed into a holding register, and is gated through a plurality of gates that feeds the complement of the digital code into a counter. The relative duration of the output signal of the last state of the counter in a logic one state corresponds to the weight of the digital code being fed into the holding register.
Official Gazette of the U.S. Patent Office

N72-25207* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMMUNICATIONS LINK FOR COMPUTERS Patent
Arthur I. Zygielbaum, James W. Layland, and Warren L. Martin, inventors (to NASA) Issued 7 Mar. 1972 18 p Filed 31 Dec. 1969 Supersedes N70-22193 (08 - 09, p 1611) Sponsored by NASA
(NASA-Case-NPO-11161; US-Patent-3,648,256; US-Patent-Appl-SN-889374; US-Patent-Class-340-172.5; US-Patent-Class-340-146.1) Avail: US Patent Office CSCL 09B

A system is disclosed for a computer to communicate with a selected one of a number of other computers through two identical communications links. A single channel connects the two links which operate at a clock rate independent of the computers. Binary digits and clock pulses are combined and converted into a three-level signal for serial transmission over the single channel. Both control messages and data words may be transmitted. Each message and word transmitted is checked for error by the receiving link before it is accepted and the receiving computer is interrupted. If error is found, an error message is automatically transmitted to the originating computer.
Official Gazette of the U.S. Patent Office

N72-25208* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD AND APPARATUS FOR FREQUENCY-DIVISION MULTIPLEX COMMUNICATIONS BY DIGITAL PHASE SHIFT OF CARRIER Patent
Lucien A. Couvillon, Jr., inventor (to NASA) Issued 25 Apr. 1972 8 p Filed 13 Nov. 1970 Supersedes N71-33923 (09 - 20, p 3237) Sponsored by NASA
(NASA-Case-NPO-11338; US-Patent-3,659,053; US-Patent-Appl-SN-89212; US-Patent-Class-179-15FD; US-Patent-Class-178-50; US-Patent-Class-179-15BC; US-Patent-Class-325-62; US-Patent-Class-332-21) Avail: US Patent Office CSCL 09B

A system is disclosed for subcarrier frequency multiplexing to separate independent pulse-code-modulated data streams on a common carrier by modulating the carrier in a digital-to-phase shift converter. Codes are produced in an encoder as Boolean functions of the data, subcarriers, and mode control signals are treated as binary variables. The mode control variable is included in program ratios between modulated subcarriers. Alternatively, 2 in. registers can be provided to store m-bit words representing different carrier phases. The codes are selected as functions of the subcarriers and data. The contents of the registers can be changed under control of a computer or data processing system.
Official Gazette of the U.S. Patent Office

N72-25209* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BINARY CODED SEQUENTIAL ACQUISITION RANGING SYSTEM Patent
Warren L. Martin and Richard M. Goldstein, inventors (to NASA) Issued 25 Apr. 1972 13 p Filed 13 Aug. 1970 Supersedes N71-33869 (09 - 20, p 3239) Sponsored by NASA
(NASA-Case-NPO-11194; US-Patent-3,659,292; US-Patent-Appl-SN-63532; US-Patent-Class-343-6.5R; US-Patent-Class-343-12R; US-Patent-Class-343-14) Avail: US Patent Office CSCL 09B

A binary coded sequential acquisition ranging system for determining the distance of very distant objects, such as extraterrestrial probes, is disclosed. A ground transmitter including a phase modulator and a digital coder is employed to sequentially transmit code components to a probe transponder for retransmission to a ground ranging circuit which serves to compare the returned code components with locally generated Doppler compensated reference code components. The ranging circuit includes a receiver digital coder that is a counterpart of the transmitter digital coder, and an adder circuit which serves to effectively Doppler compensate the receiver digital coder in accordance with detached Doppler shift frequencies to provide the reference code components. A ranging receiver is employed to detect the relative phase difference between reference code components and returned code components.
Official Gazette of the U.S. Patent Office

N72-25210* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MOD 2 SEQUENTIAL FUNCTION GENERATOR FOR MULTIBIT BINARY SEQUENCE Patent

Tage O. Anderson, inventor (to NASA) Issued 9 May 1972 7 p Filed 1 Oct. 1970 Supersedes N71-33493 (09 - 20, p 3292) Sponsored by NASA
(NASA-Case-NPO-10636; US-Patent-3,662,337; US-Patent-Appl-SN-77221; US-Patent-Class-340-146.1AL; US-Patent-Class-235-152) Avail: US Patent Office CSCL 09B

A MOD 2 sequential function generator for a n-bit binary sequence comprising a two-bit shift register for each pair of bits in the sequence is described. The false output of the register serves as the true input to the register. The input and output bits of each register are initially loaded to a 1 and 0 state, respectively. The true outputs of the registers are MOD 2 added to provide the generator's final output.

Official Gazette of the U.S. Patent Office

N72-25211* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SYSTEM FOR AUTOMATICALLY AND MANUALLY TESTING LINES FOR DETERMINING IF INFORMATION CAN BE ACCURATELY TRANSMITTED THEREON Patent
Leo O. Richards and Walter E. Parsons, inventors (to NASA) Issued 23 May 1972 30 p Filed 4 Dec. 1969 Supersedes N70-20719 (08 - 08, p 1413)
(NASA-Case-KSC-10385; US-Patent-3,665,303; US-Patent-Appl-SN-882123; US-Patent-Class-324-73; US-Patent-Class-324-51; US-Patent-Class-340-413) Avail: US Patent Office CSCL 09B

A hardline system is described for monitoring a number of lines over which signals are transmitted in order to determine if the characteristics of the lines are within certain predetermined tolerances. The monitoring system includes a programmer, an electronic scanner, an analyzer, a display and control panel, a signal generator, a computer interface unit, and a checkout computer. In operation, the electronic scanner, which is under the control of the programmer, scans the hardlines or cables over which the signals are transmitted. The programmer couples these lines through the scanner to an analyzer which analyzes the signals to determine if there is any distortion or deterioration of the line. If the signals being transmitted are out of tolerance, then the analyzer sends such information to a display and control panel to illuminate a lamp. Such information is also fed to a checkout computer through a computer interface unit and the programmer. A signal generator is provided for placing continuous data signals, FM signals, and wordburst signals on the line when such is necessary. Official Gazette of the U.S. Patent Office

N72-25212 Arizona Univ., Tucson.
DARE 3, A TIME SHARED DIGITAL SIMULATION SYSTEM Ph.D. Thesis
Hans Magnus Aus 1971 120 p
Avail: Univ. Microfilms Order No. 71-25138

The DARE 3, an on-line, time-shared all-digital simulation system is described. The system combines the text editing and data input/output features of a 16K DEC PDP-9 mini computer with the full floating point arithmetic power of a large CDC 6400 computer. Simulation problems with 100 parameters, 200 system differential equations, and 300 output variables may be formulated and run with DARE 3. Problem equations and solutions are entered and displayed at the remote of PDP-9 terminal using cathode ray tube displays, keyboards, and XY graphic plotters. The system contains all routines needed to formulate and run a simulation problem. A choice of several fixed step and a variable step Runge-Kutta integration routine is available. The system is designed so that additional integration routines can easily be added as they are developed.

Dissert. Abstr.

N72-25213*# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
CONCEPTUAL DESIGN AND FEASIBILITY EVALUATION MODEL OF A 10 TO THE 8TH POWER BIT OLIGATOMIC MASS MEMORY. VOLUME 1: CONCEPTUAL DESIGN Final Summary Report
A. L. Recksiedler and C. L. Lutes Feb. 1972 216 p 3 Vol.
(Contract NAS8-26670)
(NASA-CR-123635; PX-6676-Vol-1) Avail: NTIS HC $13.00 CSCL 09B

The oligatomic (mirror) thin film memory technology is a suitable candidate for general purpose spaceborne applications in the post-1975 time frame. Capacities of around 10 to the 8th power bits can be reliably implemented with systems designed around a 335 million bit module. The recommended mode was determined following an investigation of implementation sizes ranging from an 8,000,000 to 100,000,000 bits per module. Cost, power, weight, volume, reliability, maintainability and speed were investigated. The memory includes random access, NDRO, SEC-DED, nonvolatility, and dual interface characteristics. The applications most suitable for the technology are those involving a large capacity with high speed (no latency), nonvolatility, and random accessing. Author

N72-25214*# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
CONCEPTUAL DESIGN AND FEASIBILITY EVALUATION MODEL OF A 10 TO THE 8TH POWER BIT OLIGATOMIC MASS MEMORY. VOLUME 2: FEASIBILITY EVALUATION MODEL Final Summary Report
R. L. Horst and M. J. Nordstrom Feb. 1972 142 p 3 Vol.
(Contract NAS8-26670)
(NASA-CR-123533; PX-6676-Vol-2) Avail: NTIS HC $9.25 CSCL 09B

The partially populated oligatomic mass memory feasibility model is described and evaluated. A system was desired to verify the feasibility of the oligatomic (mirror) memory approach as applicable to large scale solid state mass memories. Author

N72-25215*# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
CONCEPTUAL DESIGN AND FEASIBILITY EVALUATION MODEL OF A 10 TO THE 8TH POWER BIT OLIGATOMIC MASS MEMORY. VOLUME 3: OPERATION MANUAL Final Summary Report
R. L. Horst and M. J. Nordstrom Feb. 1972 144 p 3 Vol.
(Contract NAS8-26670)
(NASA-CR-123634; PX-6676-Vol-3) Avail: NTIS HC $9.25 CSCL 09B

An operation manual is presented for the oligatomic mass memory feasibility model. It includes a brief description of the memory and exerciser units, a description of the controls and their functions, the operating procedures, the test points and adjustments, and the circuit diagram. Author

N72-25216*# M&S Computing, Inc., Huntsville, Ala.
MULTI-PROCESSING CONTROL SYSTEM FOR THE SEL 840MP (MPCS/1) USERS GUIDE. VOLUME 1: PROGRAMMING GUIDE
27 Mar. 1972 91 p
(Contract NAS8-27359)
(NASA-CR-123559; Rept-72-0012-Vol-1) Avail: NTIS HC $6.75

A programmer's manual is presented for the SEL 840MP multiprocessing control system MPCS. The topics discussed include task control; defining displays; MPCS calls for task control functions; MPCS calls and system interfaces for display functions; MPCS calls for input/output functions and services, file management, and utility services; and MPCS assembly language call sequence summary. K.P.D.

N72-25217*# M&S Computing, Inc., Huntsville, Ala.
MULTI-PROCESSING CONTROL SYSTEM FOR THE SEL 840MP (MPCS/1) USERS GUIDE. VOLUME 2: OPERATIONS GUIDE
27 Mar. 1972 61 p
(Contract NAS8-27359)
(NASA-CR-126668; Rept-72-0012-Vol-2) Avail: NTIS CSCL

09B

The generation and operational use of the SEL 840MP multiprocessing control system (MPCS) are considered. System initialization, job task table generation, the MPCS command language, display library generation, and system error summary are reviewed. K.P.D.

N72-25218*# Federal Electric Corp., Paramus, N.J. Systems Quality Branch.
SCIENTIFIC COMPUTATION SYSTEMS QUALITY BRANCH MANUAL
7 Jan. 1972 178 p Revised
(Contract NAS10-4967)
(NASA-CR-126770) Avail: NTIS HC $11.00 CSCL 09B

A manual is presented which is designed to familiarize the GE 635 user with the configuration and operation of the overall system. Work submission, programming standards, restrictions, testing and debugging, and related general information is provided for GE 635 programmer. Author

N72-25219*# Shock Hydrodynamics, Inc., Sherman Oaks, Calif.
STEEP32 COMPUTER CODE Final Report
W. S. Goerke Mar. 1972 188 p refs
(Contract NAS8-25918)
(NASA-CR-126749) Avail: NTIS HC $11.50 CSCL 09B

A manual is presented as an aid in using the STEEP32 code. The code is the EXEC 8 version of the STEEP code (STEEP is an acronym for shock two-dimensional Eulerian elastic plastic). The major steps in a STEEP32 run are illustrated in a sample problem. There is a detailed discussion of the internal organization of the code, including a description of each subroutine. Author

N72-25220# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
AN ASTRONOMICAL COMPUTER PROGRAM PACKAGE FOR THE ONSALA SPACE OBSERVATORY
P. G. Landgren and B. O. Roennaeng 1971 45 p refs
(RR-102) Avail: NTIS HC $4.25

The development and practical use of a series of FORTRAN programs for astronomy are discussed. The programs include: (1) Doppler velocity calculation, (2) source precession determination, (3) nutation and aberration calculation, (4) Julian day number calculator, (5) siderealtime calculation, (6) determination of the parameters of a very long baseline interferometer, and (7) A pre-VLBI program to calculate fringe rate, delay and spatial frequency components for very long baseline interferometry experiment. A few simple programs are also included, such as to find the day of the week of an arbitrary date and a routine to convert between different spherical coordinate systems. Author

N72-25221# RAND Corp., Santa Monica, Calif.
COMPUTERS AND NATIONAL SECURITY
Edwin W. Paxson Jan. 1972 51 p refs Submitted for publication
(P-4728) Avail: NTIS HC $4.75

The current status of computers in respect to national defense is assessed. The impact of computers after World War 2, and computer modification of analysis in support of military decisions are outlined. Military roles of computers include combat, communications, intelligence, and logistics support. E.H.W.

N72-25222*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COUNTING DIGITAL FILTERS Patent Application
Shalhav Zohar, inventor (to NASA) Filed 20 Mar. 1972 45 p
(Contract NAS7-100)
(NASA-Case-NPO-11821-1; NASA-Case-NPO-11831; NASA-Case-NPO-11832; NASA-Case-NPO-11833; US-Patent-Appl-SN-236285) Avail: NTIS HC $4.25 CSCL 09B

Several embodiments of a counting digital filter of the nonrecursive type are disclosed. In each embodiment two registers, at least one of which is a shift register, are included. The shift register receives J sub x-bit data input words bit by bit. In the shift register wherein the data words are fed in a monotonic word index sequence, they are separated by J sub a-1 spacing zero bits, where J sub a represents the number of bits of each of K filter coefficients stored in the other register. An output sample Y sub m is computed as a function of J components. Since binary quantities only are involved, each product is determined as the output of a two-input AND gate. The double summation is carried out simply by counting all true AND gates. NASA

N72-25223*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: REAL-TIME AUXILIARY COMPUTING FACILITY DEVELOPMENT
Charles E. Allday Washington Jun. 1972 13 p
(NASA-TN-D-6855; MSC-S-326) Avail: NTIS HC $3.00 CSCL 09B

The Apollo real time auxiliary computing function and facility were an extension of the facility used during the Gemini Program. The facility was expanded to include support of all areas of flight control, and computer programs were developed for mission and mission-simulation support. The scope of the function was expanded to include prime mission support functions in addition to engineering evaluations, and the facility became a mandatory mission support facility. The facility functioned as a full scale mission support activity until after the first manned lunar landing mission. After the Apollo 11 mission, the function and facility gradually reverted to a nonmandatory, offline, on-call operation because the real time program flexibility was increased and verified sufficiently to eliminate the need for redundant computations. The evaluation of the facility and function and recommendations for future programs are discussed in this report. Author

N72-25224*# Massachusetts Inst. of Tech., Cambridge.
PROJECT MAC Progress Report, Jul. 1970 - Jul. 1971
J. C. R. Licklider and Edward Fredkin 1 Jul. 1971 248 p refs
(Contract NAS12-2093; Grant NGR-22-009-393; Contracts N00014-70-A-0362-0001; DAHC15-69-C-0347; N00014-69-A-0276-0002; Grants NSF GJ-432; NSF GJ-1049)
(NASA-CR-122427; PR-8) Avail: NTIS HC $14.50 CSCL 09B

On-line programming for the following topics is discussed: (1) artificial intelligence, (2) automata theory, (3) cellular automata, (4) computation structures, (5) computer systems research, (6) dynamic modeling, computer graphics, and computer networks, (7) education, (8) implicit computation, (10) interactive management systems, (11) interactive algebraic manipulation, and (12) programming languages. K.P.D.

N72-25225# Rice Univ., Houston, Tex.
ON THE METHOD OF MULTIPLIERS FOR MATHEMATICAL PROGRAMMING PROBLEMS
A. Miele, P. E. Moseley, A. V. Levy, and G. M. Coggins 1972 52 p refs
(Grant NSF GP-32453)
(AAR-99) Avail: NTIS HC $4.75

The numerical solution of the basic problem of mathematical programming is considered. This consists of minimizing a function f(x) subject to a constraint phi(x) = 0. Two modifications of the method of multipliers are presented in order to improve its convergence characteristics. Evaluation of the theory is accomplished with seven numerical examples. The first example pertains to a quadratic function subject to linear constraints. The remaining examples pertain to nonquadratic functions subject to nonlinear constraints. Each example is solved with the ordinary gradient algorithm, the conjugate gradient algorithm, and the modified quasilinearization algorithm. Author

N72-25226# Technische Universitaet, Brunswick (West Germany).
ON THE USE OF ELECTRONIC DATA PROCESSING SYSTEMS FOR OPERATIONAL INPUT OF ELECTRIC SWITCHGEARS Ph.D. Thesis [UEBER DEN EINSATZ ELEKTRONISCHER DATENVERARBEITUNGSANLAGEN IM ANGEBOTSWESEN VON ELEKTRISCHEN SCHALTANLAGEN]
Wilfried Habermann 1971 156 p refs In GERMAN
Avail: NTIS HC $5.00

Algorithms and programming blocks for the computerized regulation of operational switchgear demands are considered. Mathematical programming for systems optimization includes technological network and switching data, electrical characteristics, design configurations, field arrangements, maximum allowable configuration measurements, etc. Transl. by G.G.

N72-25227# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
A NEUTRON MOMENTS COMPUTER CODE, MOMENT 1
Charles M. Eisenhauer, George L. Simmons, and Lewis V. Spencer May 1972 40 p refs
(NBS-TN-725) Avail: SOD $0.50 as C 13.46:725

A computer code is discussed for generating spatial-angular moments of neutron flux in an infinite medium. The equation for the flux moments is given and the techniques used for the solution are discussed. The structure of the computer code and of the main subroutines is also discussed. Details of the input and output data are given and the printout from a sample problem is included. Author

N72-25228# Bureau of Mines, Washington, D.C.
COMPUTER SIMULATION OF PARTICULATE SYSTEMS
Lindsay D. Norman et al 1971 58 p refs
(BM-Bull-658) Avail: SOD $0.60 as I 28.3:658

Computer models for simulating the construction and calculating the properties of particulate solids in two- and three-dimensional systems (coverings of circles and packings of spheres, respectively) were developed. By simulating the physical process of constructing circle coverings and sphere packings, in which the circles or spheres were randomly selected from many different distributions of sizes, physically realizable loose random assemblies were simulated whose physical and geometrical properties were predictable with the computer. All of these properties were easily and accurately calculated by the computer models for many different coverings and packings constructed from equal, discrete, uniform, and log-normal distributions of particles. Dense random covering and packing constructions were simulated whose properties are ideal upper limits for those of the loose random coverings and packings. The properties of the dense random coverings and packings were also obtained. The statistical geometry of loose random coverings and packings was studied, and several new interpretations of the area-covering or space-filling requirements in these systems were made. Author

N72-25229# Rice Univ., Houston, Tex.
UPDATING RULES FOR THE PENALTY CONSTANT USED IN THE PENALTY FUNCTION METHOD FOR MATHEMATICAL PROGRAMMING PROBLEMS
A. Miele, G. M. Coggins, and A. V. Levy 1972 42 p refs
(Grant NSF GP-32453)
(AAR-90) Avail: NTIS HC $4.25

The penalty function method is investigated, that is, a sequence of unconstrained minimization problems is solved, each of which involves the penalty function $U(x, k) = f(x) + kP(x)$. Two variable rate updating rules are developed. In order to evaluate these updating rules, six numerical examples are investigated. The first example deals with a quadratic function subject to linear constraints; the remaining examples deal with nonquadratic functions subject to nonlinear constraints. Each example is solved with the conjugate-gradient algorithm and the modified-quasilinearization algorithm for five starting values of the penalty constant. For each example, the variable-rate updating rules are compared with the constant rate updating rules pi = 5 and pi = 10. Author

N72-25230*# Radiation, Inc., Melbourne, Fla. Radiation Systems Div.
DATA COMPRESSION/ERROR CORRECTION DIGITAL TEST SYSTEM. APPENDIX 3: MAINTENANCE. BOOK 1: TRANSMITTER ASSEMBLY DRAWINGS Final Report
Jan. 1972 148 p
(Contract NAS9-10441)
(NASA-CR-115597; Rept-86-185A-App-3-Bk-1) Avail: NTIS HC $9.50 CSCL 09B

Assembly drawings, logic schematics, and circuit schematics useful in maintaining the equipment of the DC/EC digital test system are reviewed. The drawings are organized in accordance with the reference designations of the hardware. The transmitter subsystem assembly drawings are emphasized. Author

N72-25231*# Radiation, Inc., Melbourne, Fla. Radiation Systems Div.
DATA COMPRESSION/ERROR CORRECTION DIGITAL TEST SYSTEM. APPENDIX 2: THEORY OF OPERATION Final Report
Jan. 1972 163 p ref
(Contract NAS9-10441)
(NASA-CR-115606; Rept-86185F-App-2) Avail: NTIS HC $10.25 CSCL 09B

An overall block diagram of the DC/EC digital system test is shown. The system is divided into two major units: the transmitter and the receiver. In operation, the transmitter and receiver are connected only by a real or simulated transmission link. The system inputs consist of: (1) standard format TV video, (2) two channels of analog voice, and (3) one serial PCM bit stream. Author

N72-25232*# Radiation, Inc., Melbourne, Fla. Radiation Systems Div.
DATA COMPRESSION/ERROR CORRECTION DIGITAL TEST SYSTEM. APPENDIX 3: MAINTENANCE. BOOK 2: RECEIVER ASSEMBLY DRAWINGS Final Report
Feb. 1972 351 p
(Contract NAS9-10441)
(NASA-CR-115607; Rept-86-185B-App-3-Bk-2) Avail: NTIS HC $19.75 CSCL 09B

The assembly drawings of the receiver unit are presented for the data compression/error correction digital test system. Equipment specifications are given for the various receiver parts, including the TV input buffer register, delta demodulator, TV sync generator, memory devices, and data storage devices. J.A.M.

N72-25233# European Space Research Organization, Paris (France).
SPACECRAFT OPERATIONS. VOLUME 6: COMPUTER AND DATA HANDLING
Mar. 1972 87 p refs Partly in ENGLISH and partly in FRENCH Proc. of the 8th ESRO Summer School, Neu-Isenburg, West Ger., 1970
(ESRO-SP-69) Avail: NTIS HC $6.50

The role of the computer in space operations centers is described together with the development of the hardware and software, and the S-C 4060 stored program recording system, a computer-driven microfilm plotter, is reviewed. The main aspects of data acquisition and presentation for spacecraft control, data processing, and real time operation are also discussed. For individual titles, see N72-25234 through N72-25242.

N72-25234# European Space Operations Center, Darmstadt (West Germany).
THE ROLE OF THE COMPUTER IN A SPACE OPERATIONS CENTRE: THE DEVELOPMENT OF HARDWARE AND

SOFTWARE
P. R. Becker *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 1-8 (See N72-25233 16-08)
Avail: NTIS HC $6.50

The evolution of computers available at space operations centers since 1964 is surveyed, and the development of hardware and software is reported. The desirable improvements are underlined. The highlights of software development between 1949 and 1968 are described. Author (ESRO)

N72-25235# European Space Operations Center, Darmstadt (West Germany).
S-C 4060 STORED PROGRAM COMPUTING SYSTEM
Anders Krogvig *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 9-18 (See N72-25233 16-08)
Avail: NTIS HC $6.50

The S-C 4060 stored program recording system, a computer-driven microfilm plotter, in use at ESCO is described. Following a short survey of the functional organization of the system, the various components of the hardware (CRT, camera, film developer, and hardcopy unit) and software packages are reviewed. Author (ESRO)

N72-25236# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
ORGANIZATION AND ROLE OF THE CNES COMPUTER CENTER AT BRETIGNY [ORGANISATION ET ROLE DU CENTRE DE CALCUL DU CNES A BRETIGNY]
D. Hermelin *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 19-36 In FRENCH (See N72-25233 16-08)
Avail: NTIS HC $6.50

The role, function, equipment (CDC 6600 and 1700 computers), and activities of the computer center at CNES are described in relation to processing of satellite location data. The network for real time data acquisition is discussed, taking into account the data processing for the Eole and D-2 programs. Author (ESRO)

N72-25237# European Space Operations Center, Darmstadt (West Germany).
DATA ACQUISITION AND PRESENTATION FOR SPACECRAFT CONTROL **c07**
B. D. Brown *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 38-44 (See N72-25233 16-08)
Avail: NTIS HC $6.50

The acquisition of the data necessary to control a spacecraft is discussed with reference to real-time and playback recording. The ways in which the acquired data are presented to the spacecraft controller within the ESRO network are described. Author (ESRO)

N72-25238# European Space Operations Center, Darmstadt (West Germany).
DATA PROCESSING AT ESOC FOR EXPERIMENTERS
G. F. Fooks *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 45-49 (See N72-25233 16-08)
Avail: NTIS HC $6.50

A general description of the data processing system is given, with stress on the interfaces with experimenters, the operational divisions and the project group, and the constraints placed on the system by the spacecraft telemetry, orbit, and attitude. Orbital data and attitude determination processing are briefly discussed; attention is drawn to the need for automatic methods of production control to ensure smooth operation of the processing system. Quality control requirements with regard to bad or dubious data, and ways and means of ensuring the accurate recording of all detected errors are given. Storage of data for archives, data retrieval, and the setting up of a data bank are referred to. Attention is drawn to production problems and to the need for careful forward planning in the system design so that interface problems and production techniques may be adequately understood and planned for and all major problems foreseen and necessary actions anticipated. Author (ESRO)

N72-25239# European Space Operations Center, Darmstadt (West Germany).
SPACE DATA SERVICE **c30**
K. G. Lenhart *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 50-57 refs (See N72-25233 16-08)
Avail: NTIS HC $6.50

Some of the data are described, such as information on solar activity, warnings of geophysical events, ground based data for correlation with satellite experiments, and geomagnetic field data. The influence of radiation on spacecraft equipment is discussed, as well as the need for studies on trapped radiation environment. Attention is drawn to the information contained in existing star catalogs and its use in a form compatible to a digital computer, either as punch cards or written onto magnetic tape. It is concluded that an increase in the minimum space data service would be of benefit both to experimenters and to the operations center as a whole. Author (ESRO)

N72-25240# European Space Operations Center, Darmstadt (West Germany).
REVIEW OF REAL TIME SPACECRAFT DATA PROCESSING SYSTEMS AT ESOC
J. G. Noyes *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 60-66 (See N72-25233 16-08)
Avail: NTIS HC $6.50

After considering the various time scales of operations that can be covered by the term real-time, the characteristics of the ESRO real time system are summarized. Techniques to improve the basic situation are discussed, such as direct connection of a ground station output to the main computer, use of peripheral computers (IBM 1800 series), and multiprogramming. Author (ESRO)

N72-25241# European Space Operations Center, Darmstadt (West Germany).
TECHNIQUES FOR LARGE-SCALE DATA HANDLING
N. R. Reeder *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 67-76 (See N72-25233 16-08)
Avail: NTIS HC $6.50

The evolution of satellite data processing at ESOC is described drawing on experience gained with ESRO satellites. The three successive systems already used are discussed, with emphasis on the characteristics of the present system and its future improvements to be incorporated for the TD-1 and ESRO-4 projects. Author (ESRO)

N72-25242# Atomic Weapons Research Establishment, Aldermaston (England).
A REVIEW OF THE GROUND DATA PROCESSING DATA OF SOME OF THE US/UK SATELLITES
T. L. vanRaalte *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 77-83 (See N72-25233 16-08)
Avail: NTIS HC $6.50

Some of the practical solutions adopted for data processing of the UK Ariel satellites are described. The extent to which theoretical principles and preliminary plans have to be adjusted daily to meet practical requirements imposed by unforeseen circumstances are considered. Author (ESRO)

N72-25243# Laboratoire Central de Recherches Thomson, Orsay (France).
DESIGN OF PRINTED CIRCUITS IN CONVERSATIONAL MODE USING GRAPHIC DISPLAY DEVICES [ELABORATION CONVERSATIONNELLE DE CIRCUITS IMPRIMES AU MOYEN D'UNE CONSOLE GRAPHIQUE]
F. Peze Apr. 1971 68 p refs In FRENCH
(Contract DRME-69.34.359-00-480)
(FP/LP-DR5-1.501/71) Avail: NTIS HC $5.50

A system was designed for implementation of a conversational mode program for drawing printed circuit boards using a graphical display device. The use of the different keys is explained, and the level of man-machine interaction is discussed.
Author (ESRO)

N72-25244# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
A NOTE ON THE USE OF VARIABLES IN ALGOL 60
B. A. Wichmann Feb. 1972 16 p refs
(NPL-NAC-14) Avail: NTIS HC $3.00

A simple distribution is derived for the use of variables in ALGOL 60, involving the total number of declarations and uses. The distribution is a negative exponential. The consequences of this in terms of the address length required for a computer are analyzed.
Author (ESRO)

N72-25245# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
ALGORITHMS FOR THE PRODUCTION OF CONTOUR MAPS OVER AN IRREGULAR TRIANGULAR MESH
B. R. Heap Mar. 1972 31 p refs
(NPL-NAC-10) Avail: NTIS HC $3.75

For the solution of partial differential equations by finite element methods, the region over which the solution is required is often divided up into an irregular triangular mesh. Algorithms are given for the production of contour maps of functions defined at the vertices of such meshes. The ALGOL implementations are appended. In the first algorithm each triangular element is dealt with in turn and contours of all the required heights drawn as straight lines within the element. In the other two algorithms (which are related), each contour is followed through the mesh from element to element, thereby allowing the contours to be drawn as smooth curves if required.
Author (ESRO)

N72-25246# Logicon, Inc., San Pedro, Calif.
THE ADVANCED TARGETING STUDY, PHASE 1F. VOLUME 5: SPACE PROGRAMMING LANGUAGE (MARK 3) COMPILER. PART B: USER'S MANUAL Final Report, Mar. 1970 - Jun. 1971
Richard E. Kayfes and William C. Nielsen Aug. 1971 72 p
(Contract F04701-70-C-0057; AF Proj. 3178)
(AD-735619; CS-7140-R0202-Pt-B;
SAMSO-TR-124-Vol-5-Pt-B) Avail: NTIS CSCL 09/2

The document describes how to install and use Version 1.0 of the SPL compiler.
GRA

N72-25776*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ON-BOARD PROCESSOR (OBP) FOR OAO C
Raymond Hartenstein *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 90-95 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09B

N72-25780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER PROGRAM TO EVALUATE OPTICAL SYSTEMS
Daphne Innes *In its* Significant Accomplishment in Technol., GSFC, 1970 1972 p 107-110 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09B

N72-25788*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER PROGRAM TO AUTOMATE RESIDUAL GAS ANALYSIS
H. Shapiro *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 138-239 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09B

N72-25798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULATION OF MASS STORAGE SYSTEMS OPERATING IN A LARGE DATA PROCESSING FACILITY
Richard Holmes *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 181-182 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09B

N72-25139# Joint Publications Research Service, Arlington, Va.
ON ONE METHOD OF INFORMATION OUTPUT IN SPEECH FORM FROM COMPUTERS
V. G. Velychko and V. I. Kulya *In its* Cybernetics Res. Reported 23 May 1972 p 37-45 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-25247* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OMNIDIRECTIONAL SLOT ANTENNA FOR MOUNTING ON CYLINDRICAL SPACE VEHICLE Patent
Thomas G. Campbell and Meredith W. Appleton, inventors (to NASA) Issued 28 Mar. 1972 5 p Filed 18 Sep. 1970 Supersedes N72-15195 (10 - 06, p 741)
(NASA-Case-LAR-10163-1; US-Patent-3,653,052;
US-Patent-Appl-SN-73310; US-Patent-Class-343-708;
US-Patent-Class-343-771; US-Patent-Class-343-873) Avail: US Patent Office CSCL 09E

An extremely thin microwave array antenna which is bonded circumferentially to the outside surface of a spacecraft and coated with a dielectric for thermal protection is described. This antenna is designed for a specific payload application in the S-band frequency range and provides an omnidirectional radiation pattern in the plane of the array and a near-omnidirectional pattern in the planes perpendicular to the array.
Official Gazette of the U.S. Patent Office

N72-25248* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL VIDEO DISPLAY SYSTEM USING CATHODE RAY TUBE Patent
Arthur I. Zygielbaum, Warren L. Martin, and Alexander Engel, inventors (to NASA) Issued 7 Mar. 1972 21 p Filed 13 Nov. 1970 Supersedes N71-33103 (09 - 20, p 3240) Sponsored by NASA
(NASA-Case-NPO-11342; US-Patent-3,648,250;
US-Patent-Appl-SN-89209; US-Patent-Class-340-172.5;
US-Patent-Class-340-324A) Avail: US Patent Office CSCL 09E

A digital video display system (DVDS) is disclosed for display of image, alphanumeric, and other data on a cathode ray tube with sequential raster scan and two, four, or eight gray shades. The DVDS includes a central processing unit for activating the system, selecting the X (horizontal axis) and Z (intensity modulation) modes, and designating the starting location of two successive rasters of data from a memory accessed by a data multiplexer subsystem (DMS). At the end of each raster, the DMS interrupts the computer for a new starting location of a raster of data to follow the next, while a DVDS control system is prepared for the next raster.
Official Gazette of the U.S. Patent Office

N72-25249* Honeywell, Inc., Minneapolis, Minn.
LOAD CURRENT SENSOR FOR A SERIES PULSE WIDTH MODULATED POWER SUPPLY Patent

Roland L. Hron, inventor (to NASA) Issued 16 Nov. 1971 5 p Filed 31 Jul. 1970 Supersedes N71-28471 (09 - 16, p 2570) Sponsored by NASA
(NASA-Case-GSC-10656-1; US-Patent-3,621,372; US-Patent-Appl-SN-59969; US-Patent-Class-323-17; US-Patent-Class-321-2; US-Patent-Class-323-22T; US-Patent-Class-323-DIG.1) Avail: US Patent Office CSCL 09E

A load current sensor is described which has an output filter inductor connected in series between a load and a pulse width modulated regulator. This inductor stores a portion of each pulse supplied to the load by the regulator. At the end of each pulse the stored energy in the inductor causes the current to continue flowing through the load via a freewheeling diode. This current is sampled by a sensor which is connected across the freewheeling diode and the series circuit made up of the output filter inductor and the load. The sensor comprises a gated transistor switch connected in series with a pulse transformer. The freewheeling diode has a forward conductance threshold (forward resistance) which is greater in magnitude than the series impedance of the transistor switch and the pulse transformer. Official Gazette of the U.S. Patent Office

N72-25250* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LAMP MODULATOR Patent
John R. Zeman, inventor (to NASA) Issued 25 Apr. 1972 4 p Filed 16 Dec. 1970 Supersedes N72-15199 (10 - 06, p 741)
(NASA-Case-KSC-10565; US-Patent-3,659,148; US-Patent-Appl-SN-98517; US-Patent-Class-315-135; US-Patent-Class-315-349; US-Patent-Class-330-2; US-Patent-Class-330-59; US-Patent-Class-340-332) Avail: US Patent Office CSCL 09A

An electronic apparatus for generating a visual indication of the presence and magnitude of a signal is described. The apparatus includes an amplifying transistor which amplifies an alternating electrical signal. A switching transistor is coupled to the output of the transistor and is turned on by a portion of the positive half of the cycle of the signal. When the switching transistor is turned on, it allows a capacitor to discharge therethrough for illuminating a lamp. The duration that the switching transistor turns on is directly proportional to the amplitude of the signal being monitored.
Official Gazette of the U.S. Patent Office

N72-25251* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALOG SIGNAL TO DISCRETE TIME INTERVAL CONVERTER (ASDTIC) Patent
Francisc C. Schwarz, inventor (to NASA) Issued 25 Apr. 1972 8 p Filed 11 Feb. 1970 Supersedes N70-25866 (08 - 12, p 2189)
(NASA-Case-ERC-10048; US-Patent-3,659,184; US-Patent-Appl-SN-10329; US-Patent-Class-321-2; US-Patent-Class-307-261; US-Patent-Class-321-18) Avail: US Patent Office CSCL 09E

An electronic signal conversion device is disclosed. The concept of pulse modulation includes, in this invention, the process of sampling a source of electric energy by one of several switches, and the electronic function that controls this switch or switches. The device is useful wherever conversion of analog signals to discrete time signal intervals for purpose of pulse modulation is required. However, the invention has general utility and is presently being used with specific power supplies in the space program and communication technology. The device lends itself to incorporating a reference source and feedback network, as used with power amplifiers and direct current pulse modulated power converters. The device maintains its accuracy of expected operation notwithstanding variations in its component characteristics, and variations of applied voltage waveforms and supply voltages. Official Gazette of the U.S. Patent Office

N72-25252* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROLLABLE LOAD INSENSITIVE POWER CONVERTERS Patent
Francisc C. Schwarz, inventor (to NASA) Issued 16 May 1972 22 p Filed 21 May 1970 Supersedes N70-35582 (08 - 19, p 3516)
(NASA-Case-ERC-10268; US-Patent-3,663,940; US-Patent-Appl-SN-39342; US-Patent-Class-321-2; US-Patent-Class-321-11; US-Patent-Class-321-18; US-Patent-Class-321-19; US-Patent-Class-321-45R; US-Patent-Class-321-45ER) Avail: US Patent Office CSCL 09E

Circuitry is reported for converting dc or ac voltage to a higher or lower dc or ac voltage by directing current alternately through a pair of inductive-capacitive loops. A portion of the inductance of each loop is magnetically coupled to another inductance whose current is rectified and supplied to a load. Voltage sensing circuits are utilized to time the flow of current through the pair of loops. Energy is magnetically coupled from the load circuit to the inductance of the pair of loops to improve starting and overload operating conditions.
Official Gazette of the U.S. Patent Office

N72-25253* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A dc TO ac TO dc CONVERTER HAVING TRANSISTOR SYNCHRONOUS RECTIFIERS Patent
Edward R. Pasciutti, inventor (to NASA) Issued 16 May 1972 7 p Filed 16 Dec. 1970 Supersedes N71-28419 (09 - 16, p 2569)
(NASA-Case-GSC-11126-1; US-Patent-3,663,941; US-Patent-Appl-SN-98640; US-Patent-Class-321-2; US-Patent-Class-321-47; US-Patent-Class-331-113A) Avail: US Patent Office CSCL 09E

A dc to ac inverter is described that includes a pair of transistors driven in push-pull by means of coupling through first and second transformers, each having a saturable core, for driving a dc load through a synchronous rectifier. The synchronous rectifier includes a pair of transistors, the emitter collector junctions of which are driven with the same wave shapes as the emitter base junctions of the inverter. A circuit connecting the two transformers together includes a saturable reactor, whereby the base drive for the transistors of the inverter and the synchronous rectifier is a wave form having two relatively steep transitions in opposite directions at the moment of switch on to remove charge stored on the bases and a further relatively steep transition prior to cut-off to minimize charge stored on the bases during conducting intervals of the transistors.
Official Gazette of the U.S. Patent Office

N72-25254* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INVERTER OSCILLATOR WITH VOLTAGE FEEDBACK Patent
Kurt Willner and William T. McLyman, inventors (to NASA) Issued 16 May 1972 5 p Filed 29 Mar. 1971 Supersedes N71-34215 (09 - 21, p 3404) Sponsored by NASA
(NASA-Case-NPO-10760; US-Patent-3,663,944; US-Patent-Appl-SN-129071; US-Patent-Class-321-45R; US-Patent-Class-321-2; US-Patent-Class-331-113A) Avail: US Patent Office CSCL 10A

An oscillator is disclosed for use in an inverter for a wide range of loads. Two transistors are connected in a push-pull amplifier configuration having current feedback through primary windings of a saturable transformer connected in series with an output transformer between collectors of the transistors. Voltage feedback is provided through a third primary winding of the saturable transformer connected in series with a resistor between the collector of one transistor and a center tap in the primary winding of the output transformer.
Official Gazette of the U.S. Patent Office

N72-25255* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HALL EFFECT TRANSDUCER Patent
David L. Smith, inventor (to NASA) Issued 16 May 1972 4 p Filed 19 Mar. 1971 Supersedes N72-11230 (10 - 02, p 178)
(NASA-Case-LAR-10620-1; US-Patent-3,663,843; US-Patent-Appl-SN-125979; US-Patent-Class-310-10; US-Patent-Class-310-15) Avail: US Patent Office CSCL 09E

A device for producing output voltages directly proportional to the displacement of a rotary shaft is described. The device uses a Hall effect transducer as its primary component. The linearity of the transducer is extended to a range of input shaft rotation up to plus or minus 50 degrees by means of a special Hall probe. P.N.F.

N72-25256* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RADIO FREQUENCY FILTER DEVICE Patent
Jerrold L. Miertschin and David H. Butler, inventors (to NASA) Issued 16 May 1972 5 p Field 28 May 1970 Supersedes N70-35191 (08 - 19, p 3513)
(NASA-Case-XLA-02609; US-Patent-3,663,929; US-Patent-Appl-SN-41347; US-Patent-Class-339-143R; US-Patent-Class-333-79; US-Patent-Class-339-147R) Avail: US Patent Office CSCL 09A

An electrical connector which serves as a radio frequency interference shield is described. The device consists of a pin assembly coated with a dielectric and a radio frequency energy absorbing sleeve surrounding the dielectric. The primary advantages of the device are a reduction in the number of components comprising the filter, elimination of solder joints, and reduced size. An additional advantage is that fewer operations are required for manufacture. P.N.F.

N72-25257* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FAMILY OF FREQUENCY TO AMPLITUDE CONVERTERS Patent
Carrington H. Stewart, inventor (to NASA) Issued 16 May 1972 11 p Filed 16 Apr. 1971 Supersedes N72-11232 (10 - 02, p 179)
(NASA-Case-MSC-12395; US-Patent-3,663,885; US-Patent-Appl-SN-134573; US-Patent-Class-328-140; US-Patent-Class-307-233; US-Patent-Class-324-78D; US-Patent-Class-324-186; US-Patent-Class-328-136) Avail: US Patent Office CSCL 09E

A family of frequency to amplitude converters is described. The equipment converts an incoming electronic signal of complex waveform and unknown frequency into an output signal corresponding in amplitude to the unknown frequency of the input signal. The device provides accurate determination of the waveform of a complex electronic signal by using a digital to analog converter to control the signal output. P.N.F.

N72-25258* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PARAMETRIC AMPLIFIERS WITH IDLER CIRCUIT FEEDBACK Patent
Hans-Juergen C. Blume, inventor (to NASA) Issued 16 May 1972 6 p Filed 17 Dec. 1970 Supersedes N72-15196 (10 - 06, p 741)
(NASA-Case-LAR-10253-1; US-Patent-3,663,886; US-Patent-Appl-SN-99175; US-Patent-Class-330-4.5; US-Patent-Class-307-88.3) Avail: US Patent Office CSCL 09E

The development of an electronic circuit to provide idler feedback in order to reduce internally generated noise in two parametric amplifiers is discussed. The circuit consists of first and second parametric amplifiers each of which has a pump input, a signal input, and an idler input. The pump inputs are supplied by a single generator and the idler input of the first parametric amplifier is supplied from the signal produced at the idler input of the second parametric amplifier. Two modes of operation of the circuit are described, and the advantages of the two modes are analyzed. P.N.F.

N72-25259* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TUNGSTEN CONTACTS ON SILICON SUBSTRATES Patent
Joseph Epstein, inventor (to NASA) Issued 23 May 1972 7 p Filed 31 Dec. 1969 Supersedes N70-22184 (08 - 09, p 1614)
(NASA-Case-GSC-10695-1; US-Patent-3,664,874; US-Patent-Appl-SN-889422; US-Patent-Class-136-89; US-Patent-Class-29-198; US-Patent-Class-117-200) Avail: US Patent Office CSCL 09A

A process is reported whereby tungsten contact electrodes are formed on doped silicon substrates, such as integrated circuit chips and solar cells, and the resultant products. The method comprises depositing elemental tungsten on contact areas of doped silicon semiconductor devices and processing of the silicon devices to induce a chemical reaction between the tungsten and the silicon. The resulting tungsten contact electrodes include a transition region at the interface of the tungsten electrode and silicon device comprising tungsten-silicon compounds which are physically and chemically bonded to both the tungsten electrode material and the silicon semiconductor material. A lead is bonded directly to the tungsten electrode.
Official Gazette of the U.S. Patent Office

N72-25260* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL MOTOR Patent
Lloyd J. Derr and Robert A. Tobias, inventors (to NASA) Issued 16 May 1972 8 p Continuation-in-part of US Patent Appl. SN-856415, filed 9 Sep. 1969 Sponsored by NASA
(NASA-Case-NPO-11283; US-Patent-3,663,839; US-Patent-Appl-SN-118270; US-Patent-Class-310-4) Avail: US Patent Office CSCL 09E

An electrically powered actuator for providing a rotational or large linear motion, which is simple and reliable, includes a bimetallic strip with a slot extending along its length from one end to a position near the opposite end. In a rotational actuator, the strip is bent into a spiral, with the inner turn fixed to the shaft which is to be rotated and the outer turn fixed to a support and connected to electrical leads. Current passed through the leads and through the slotted strip heats it to make it uncoil or to make it coil further, the several rotations of the strip resulting in a large rotation of the shaft.
Official Gazette of the U. S. Patent Office

N72-25261* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LEAD ATTACHMENT TO HIGH TEMPERATURE DEVICES Patent
Richard Farrell, inventor (to NASA) Issued 30 May 1972 6 p Filed 23 Oct. 1969 Supersedes N70-20742 (08 - 08, p 1419)
(NASA-Case-ERC-10224; US-Patent-3,665,589; US-Patent-Appl-SN-868775; US-Patent-Class-29-492; US-Patent-Class-29-497; US-Patent-Class-29-498; US-Patent-Class-29-502; US-Patent-Class-29-589; US-Patent-Class-29-628) Avail: US Patent Office CSCL 09A

A technique is described for the attachment of leads to electronic devices which permits operation of the devices over a wide temperature range. The technique contemplates the use of core conductors having a thin coating of metal, whereby only a limited amount of coating material is available to form an alloy which bonds the core conductor to the device electrode. The electrode composition is affected only in the region adjacent the lead; the bond between the electrode and device is unaffected.
Official Gazette of the U.S. Patent Office

N72-25262* TRW Systems Group, Redondo Beach, Calif.
FAILSAFE MULTIPLE TRANSFORMER CIRCUIT CONFIGURATION Patent
Horacio Eduardo Gavira, inventor (to NASA) Issued 16 May 1972 7 p Filed 20 Oct. 1970 Supersedes N72-15205 (10 - 06, p 742) Sponsored by NASA
(NASA-Case-NPO-11078; US-Patent-3,663,828; US-Patent-Appl-SN-82280; US-Patent-Class-307-83; US-Patent-Class-307-103; US-Patent-Class-323-48;

US-Patent-Class-323-82) Avail: US Patent Office CSCL 09E

A fail-safe multiple transformer circuit configuration, useful in providing power to electrical loads, is disclosed. A circuit configuration for applying power to direct current loads includes a number of transformer circuits connected in parallel. Alternating current loads are accommodated by a number of parallel coupled transformer circuits, each including a transformer having a pair of secondary coils. Official Gazette of the U.S. Patent Office

N72-25263# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

[ELECTRICAL ENGINEERING DEVICES AND MATERIALS RESEARCH] Annual Research Summary, 1971

1972 205 p refs

Avail: NTIS HC $12.25

The research accomplished by the School of Electrical Engineering during 1971 is reported. Research areas presented include: automatic controls, bioengineering, circuits and systems, communication sciences, computers and automata, electromagnetic fields, plasmas, quantum mechanics, and energy sources and systems. Abstracts of Ph.D. dissertations for this period are also included. F.O.S.

N72-25264# Technisch Physisch Dienst TNO-TH, Delft (Netherlands). Afdeling Optiek.

PRELIMINARY RESEARCH ON DETERMINING THE RING SPECTRUM IN A CAVITY-TUNNEL [VOORTGEZET ONDERZOEK VAN DE BEPALING VAN HET BELLENSPECTRUM IN EEN CAVITATIE-TUNNEL MET BEHULP VAN HOLOGRAFIE]

N. J. vanderZwaal and H. J. Raterink 23 Dec. 1971 36 p refs In DUTCH

(TPD-1971-0-2; TDCK-059204) Avail: NTIS HC $4.00

Mechanical chopping produced exposure times of 0.4 microseconds of the ring shaped spectrum of a krypton laser on magnifying Agfapan film. Thus, it was possible to obtain a hologram of the cavity tunnel spectrum of 10 micrometer at exposure times of 7 m/s. Transl. by G.G.

N72-25265# Technische Hochschule Darmstadt (West Germany).

AMPLITUDE LIMITER AND TRIGGER SWITCHES WITH DIODES Ph.D. Thesis [AMPLITUDENBEGRENZER UND KIPPSCHALTUNGEN MIT DIODEN]

Alfred Lutz 10 Dec. 1971 87 p refs In GERMAN

Avail: NTIS HC $6.50

Phase accurate symmetrical limitations for alternating voltage are considered in order to stabilize their null passages for amplitude affected phase measurements and phase demodulations. Described are limiters with biased diodes for stabilizing thresholds between linear amplitude transfer regions. A positive feedback trigger switch with diode thresholds is described linearly and it is shown that the functions of limiter and trigger switch are similar. Superimposition of control voltage components or internal push-pull modulation produces differing limitation characteristics or decreases switching hysteresis. Transl. by G.G.

N72-25266# Technische Hochschule Darmstadt (West Germany).

PROPERTIES AND NOISE IMMUNITY OF GATE SWITCHES WITH HYSTERESIS Ph.D. Thesis [EIGENSHAFTEN UND STORSICHERHEIT VON GATTERSCHALTUNGEN MIT HYSTERESE]

Dieter Adolphs 16 Dec. 1971 136 p refs In GERMAN

Avail: NTIS HC $9.00

A general switching gate model is used to develop hysteresis gates with a feedback circuit whose right branch is regulated by the threshold voltage of a Z-diode and whose left branch by two resistor measurements. The characteristic lines of the opened feedback loop are not affected by signal delay. Gates with internal feedback circuits governed through threshold voltages of series diodes or parallel diodes also are not affected by signal delay in the feedback loop. Transl. by G.G.

N72-25267*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

REDUNDANT SPEED CONTROL FOR BRUSHLESS HALL EFFECT MOTOR Patent Application

Frank J. Nola, inventor (to NASA) Filed 30 Mar. 1972 19 p

(NASA-Case-MFS-20207-1; US-Patent-Appl-SN-239574) Avail: NTIS HC $3.00 CSCL 09E

A speed control system is described for a brushless Hall effect device equipped direct current motor. Separate windings of the motor are powered by separate speed responsive power sources. A change in speed, upward or downward, because of the failure of a component of one of the power sources, results in a corrective signal being generated in the other power source to supply an appropriate power level and polarity to one winding causing the motor to be corrected in speed. NASA

N72-25268*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INFRARED TUNABLE LASER Patent Application

Kenneth W. Billman, inventor (to NASA) Filed 6 Apr. 1972 13 p

(NASA-Case-ARC-10463-1; US-Patent-Appl-SN-241615) Avail: NTIS HC $3.00 CSCL 09E

A tunable laser apparatus is described which includes a first wavelength-selective reflector and a second wavelength-selective reflector forming one end of an optical cavity, a third wavelength selective reflector forming the other end of the optical cavity, a lasable dye solution for developing radiation of a wavelength selected by the first reflector and another dye solution for developing radiation of a wavelength selected by the second reflector disposed within the optical cavity. A nonlinear mixing crystal is disposed within the optical cavity. The selected radiation is passed through the crystal, causing it to develop radiation of a third wavelength, which is transmitted out of the optical cavity through the third reflector. NASA

N72-25269*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

FERROFLUIDIC SOLENOID Patent Application

Eric E. Sabelman, inventor (to NASA) Filed 16 Mar. 1972 18 p

(Contract NAS7-100)

(NASA-Case-NPO-11738-1; US-Patent-Appl-SN-235295) Avail: NTIS HC $3.00 CSCL 09E

An electromechanical actuator is described for producing mechanical force and/or motion in response to electrical signals. The actuator includes a ferromagnetic fluid and a coil which are contained within an elastomeric capsule. Energization of the coil by applying current to a pair of coil electrodes extending through the walls of the elastomeric capsule produces distortion of the capsule, i.e., radial expansion and axial contraction. This distortion is caused by the redistribution of the ferromagnetic fluid within the capsule under the influence of the magnetic field produced by the energized coil. Variation of the current input will produce corresponding variations in the degree of capsule distortion. NASA

N72-25270*# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.

SOLID STATE Ku-BAND POWER AMPLIFIER Final Report

Harold C. Bowers and William H. Lockyear Jan. 1972 48 p refs

(Contract NAS5-11388)

(NASA-CR-122426; W-3993) Avail: NTIS HC $4.50 CSCL 09A

The design, fabrication, and testing of two types of IMPATT diode reflection amplifiers and a transmission amplifier are given. The Ku-band IMPATT diode development is discussed. Circuitry and electrical performance of the final version of the Ku-band amplifier is described. Construction details and an outline and mounting drawing are presented. Author

N72-25271# Eidgenossische Technische Hochschule, Zurich (Switzerland).
TWO DIMENSIONAL SOLUTION FOR THE STATIONARY SEMICONDUCTOR TRANSPORT EQUATIONS OF FIELD EFFECT TRANSISTORS Ph.D. Thesis [ZWEIDIMENSIONALE LOESUNG DER INSTATIONAEREN HALBLEITERTRANSPORTGLEICHUNGEN FUER FELDEFFEKTTRANSISTOREN]
Martin Reiser 1971 107 p refs In GERMAN
(Diss-4661) Avail: NTIS HC $7.50

A numerical solution for the stationary semiconductor transport equation is formulated that applies to silicon metal Schottky-gate field effect transistors (MESFET's). A differential low order method is used to develop semiconductor equations encompassing continuity-, drift-, and Poisson-equations and to generate a computer code for calculating semiconductor stability parameters. Transl. by G.G.

N72-25272# Eidgenossische Technische Hochschule, Zurich (Switzerland).
CONSTRUCTION OF A SUPERHETERODYNE X BAND TRANSMITTER AND RECEIVER SYSTEM FOR ERP AND MRR Ph.D. Thesis [BAU EINES SUPERHET X-BAND SENDER UND EMPFANGSSYSTEMS FUER EPR UND MRR SPEKTROSKOPIE]
Fritz Schoch 1971 143 p refs In GERMAN
(Diss-4673) Avail: NTIS HC $9.25

The development of a spectrometer is reported that uses a superheterodyne receiver for high resolution electron resonance- and microwave-analyses. The device depicts energy transfer levels in spectrum lines caused by electric dipole moment couplings to the electric field energy of a coherent radiation field. Transl. by G.G.

N72-25273# Royal Aircraft Establishment, Farnborough (England).
OUTPUT FILTERS FOR AIRCRAFT TYPE CYCLOCONVERTORS
N. J. Carter Apr. 1971 44 p refs
(RAE-TR-71088; BR26007) Avail: NTIS HC $4.25

The performance of low-pass filters, suitable for cycloconvertors which might be used for the prime electrical power supply in aircraft is analyzed and discussed. Three types of filter are considered, and a computer program is used to determine the response of the filters when loads of various power factors are applied. The analysis concludes that the L section filter represents the optimum arrangement for cycloconvertor applications. Author (ESRO)

N72-25274# Admiralty Surface Weapons Establishment, Portsmouth (England).
ACCELERATED LIFE TESTING OF THICK FILM RESISTORS
P. L. Shove Sep. 1971 85 p refs
(AD-738269; ASWE-TR-71-30; BR27904) Avail: NTIS CSCL 09/1

The aim of the work was to investigate the possibility of correlating an accelerated stress test to a conventional life test for thick film resistors. The material chosen for the study was Alloys Series A, R12, R13, and R54. Results are discussed. GRA

N72-25766*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYBRID CIRCUIT MODULES FOR MOTOR COMMUTATION AND CONTROL
C. deKramer *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 48-51 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09A

N72-25773*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCRETE COMPONENT S-BAND POWER AMPLIFIER
Arthur F. Block *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 79-81 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09E

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-25275*# Martin Marietta Corp., Denver, Colo.
LINEAR MODULATOR Final Report
Apr. 1972 85 p
(Contract NAS8-25987)
(NASA-CR-123580; MCR-72-81) Avail: NTIS HC $6.25 CSCL 09C

A study of frequency division multiplexing (FDM) systems was made for the purpose of determining the system performance that can be obtained with available state of the art components. System performance was evaluated on the basis of past experience, system analysis, and component evaluation. The system study was specifically directed to the area of FDM systems using subcarrier channel frequencies from 4 kHz to 200 kHz and channel information bandwidths of dc to 1, 2, 4, 8, and 16 kHz. The evaluation also assumes that the demodulation will be from a tape recorder which produces frequency modulation of + or - 1% on the signal due to the tape recorder wow and flutter. For the modulation system it is assumed that the pilot and carrier channel frequencies are stable to within + or - .005% and that the FM on the channel carriers is negligible. The modulator system was evaluated for the temperature range of -20 degree to +85 degree while the demodulator system was evaluated for operation at room temperature. Author

N72-25276*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ORGANIZATION OF A DIGITAL SUBSYSTEM FOR GENERATING SPACECRAFT TIMING AND CONTROL SIGNALS
M. Perlman 15 May 1972 33 p refs
(Contract NAS7-100)
(NASA-CR-126971; JPL-TM-33-539) Avail: NTIS HC $3.75 CSCL 09C

A modulo-M counter (of clock pulses) is decomposed into parallel modulo-m sub i counters, where each m sub i is a prime power divisor of M. The modulo-p sub i counters are feedback shift registers which cycle through p sub i distinct states. By this organization, every possible nontrivial data frame subperiod and delayed subperiod may be derived. The number of clock pulses required to bring every modulo-p sub i counter to a respective designated state or count is determined by the Chinese remainder theorem. This corresponds to the solution of simultaneous congruences over relatively prime moduli. Author

N72-25277*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESONANCE-INERT STABILIZATION FOR SPACE STATIONS
G. L. VonPragenau Washington Jun. 1972 43 p refs
(NASA-TN-D-6731; M-214) Avail: NTIS HC $3.00 CSCL 09C

An approach to stabilizing control systems is presented which structures controllers like passive mechanical systems. The controller is visualized as a structural part with a passive behavior similar to springs, dashpots, and masses. If such a controller is connected by a proper feedback arrangement, then a passive mechanical plant cannot upset stability, regardless of masses, resonances, and three-dimensional coupling. The concept of resonance-inert stabilization is explained by structuring the controller of a simple feedback loop. Reactive functions, connections, and matrices are defined and used in the stabilization

concept. The realization of a possible Skylab control system is discussed and compared with the present design. This example demonstrates the applicability to three-dimensional problems with lagging controllers. Author

N72-25278# Defence Standards Labs., Maribyrnong (Australia).
IMPROVED PRECISION IN DIELECTRIC-LOSS MEASUREMENT
S. A. Lott, J. G. Ternan, and J. L. Wilbur-Ham May 1971 10 p ref
(TN-174) Avail: NTIS HC $3.00

Three possible methods are described for measuring dielectric loss (and Q) with greater precision than is now achieved. One of these, based on the frequencies near resonance that give one quarter pi phase shift, is considered to have potential for development into a precision measurement. It requires only frequencies to be measured, after setting to null indicator readings. Author

N72-25279# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THEORETICAL AND EXPERIMENTAL STUDIES ON ELECTROSTATIC FILTER PLATES Ph.D. Thesis [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN AN PLATTEN-ELEKTROFILTERN]
Gerhard Leutert 1971 136 p refs In GERMAN
(Diss-4608) Avail: NTIS HC $9.00

Basic properties of electrostatic gas purification are considered by theoretical calculations on the electrical discharge field of an electrostatic filter plate and by experimental evaluations of filter geometry efficiencies in aerosol precipitation. Results show that it is not possible to establish a general relationship between electrical energy absorption of the filter and precipitation capacity because electrode arrangement and dust layer resistance produce differing results. Transl. by G.G.

N72-25280*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
PARASITIC SUPPRESSING CIRCUIT Patent Application
John T. Fowler and Frank L. Raposa, inventors (to NASA) Filed 15 May 1972 10 p
(NASA-Case-ERC-10403-1; US-Patent-Appl-SN-253405) Avail: NTIS HC $3.00 CSCL 09C

A circuit for suppressing parasitic oscillations across an inductor operating in a resonant mode is described. The circuit includes a switch means and resistive means connected serially across the inductor. A unidirectional resistive-capacitive network is also connected across the inductor and to the switch means to automatically render the switch means conducting when inductive current through the inductor ceases to flow. NASA

N72-25281*# Martin Marietta Corp., Denver, Colo.
DERIVATION OF A TANGENT FUNCTION USING AN INTEGRATED CIRCUIT FOUR QUADRANT MULTIPLIER Patent Application
Bernard J. Bregman, inventor (to NASA) Filed 17 May 1972 11 p Sponsored by NASA
(NASA-Case-MSC-13907-1; US-Patent-Appl-SN-254177) Avail: NTIS HC $3.00 CSCL 09C

A tangent function generator is provided which utilizes input signals proportionate to the sine and cosine of a given angle. The equipment accomplishes a trigonometric manipulation which forms an output signal substantially independent of the input reference voltage but proportional to the tangent of the angle. The device uses a multiplier and operational amplifier. NASA

N72-25282# Institut Franco-Allemand de Recherches, St. Louis (France).
DISPLACEMENT OF AN ELECTRIC ARC BY ASYMMETRICAL HEATING OF THE ARC COLUMN USING HF PULSED RADIATION Ph.D. Thesis - Munich Univ. [VERLAGERUNG EINES LICHTBOGENS DURCH UNSYMMETRISCHE AUFHEIZUNG DER BOGENSAEULE MITTELS GEPULSTER HOCHFREQUENZSTRAHLUNG]
M. Schwertl 5 Oct. 1971 101 p refs In GERMAN
(ISL-29/71) Avail: NTIS HC $7.25

The gas column of a low voltage argon wall stabilized electric arc was asymmetrically heated using high frequency radiation. The arc was thus deflected from its axisymmetrical rest position. Heating was performed by using an X-bond pulsed radar emitter which generates energetic radiation through an open wave guide situated at a distance from the arc. The deflection was measured as a function of the current intensity, the high frequency power, and the distance. Intervening factors were analyzed in terms of arc voltage variation and intensity of the emitted radiation. An energy balance model for an asymmetrical arc makes possible the calculation of the value and the distribution of the absorbed high frequency power. ESRO

N72-25283# Laboratoire Central de Recherches Thomson, Orsay (France).
STUDY OF A SERIES OF ELECTRONIC AND IONIC TECHNIQUES FOR THE DESIGN OF HIGH RESOLUTION ACTIVE AND PASSIVE DEVICES [ETUDE D'UN ENSEMBLE DE TECHNIQUES ELECTRONIQUES ET IONIQUES PERMETTANT LA REALISATION DE DISPOSITIFS ACTIFS ET PASSIFS DE HAUTE RESOLUTION]
O. Cahen, A. Bobenrieth, and A. Dubee Jul. 1970 115 p refs In FRENCH
(Contract DGRST-68/470)
Avail: NTIS HC $7.75

Specialized machines were designed using superposition of tracks for producing miniaturized electronic components by electron masking, associated with engraving on thin films by ion bombardment, and with ion injection. All operations were carried out on a 2N 918 transistor reduced 3.5 times and subsequently 7 and 14 times. Errors in dimensions or superposition were reduced to less than 0.1 micron. Author (ESRO)

N72-25774*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT DATA SYSTEMS USING LSI P-CHANNEL MOSFETS
James H. Trainor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 82-86 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09C

N72-25137# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF AXIOMATIC APPROACH TO THE CONSTRUCTION OF THE THEORY OF LOGIC-DYNAMIC CONTROL SYSTEMS, PART 2
K. D. Zhuk *In its* Cybernetics Res. Reported 23 May 1972 p 14-29 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

N72-25138# Joint Publications Research Service, Arlington, Va.
AUTOMATA BEHAVIOR IN RANDOM MEDIA WITH RESTRICTED LENGTH OF INPUT WORDS
E. M. Vavilov and K. L. Kostov *In its* Cyberetics Res. Reported 23 May 1972 p 30-36 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-25284* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABLE ANGLE TUBE HOLDER Patent
Artie D. Jessup, inventor (to NASA) Issued 14 Mar. 1972 4 p Filed 5 Nov. 1969 Supersedes N70-21006 (08 - 08, p 1427)
(NASA-Case-LAR-10507-1; US-Patent-3,649,462; US-Patent-Appl-SN-874177; US-Patent-Class-195-127) Avail: US Patent Office CSCL 14B

The development of variable angle tube holder is discussed. The device consists of a test tube rack suspended between two ends of a frame which permits pivoting to a variety of angles with clamps to hold the rack at the desired angular position. The device is used with agar cultures to permit variations at which the test tube is held to permit optimum drying characteristics.
P.N.F.

N72-25285 Maryland Univ., College Park.
A LUNAR TRANSPORTATION VEHICLE, VOLUMES 1 AND 2 Ph.D. Thesis
John Jellinek 1971 521 p
Avail: Univ. Microfilms Order No. 71-25275

The description of the locomotion and response of a proposed lunar surface vehicle are presented. It is shown that for the type of terrain to be encountered on the Moon, the surface vehicle will need both walking and conventional wheel rotation capabilities. The walking capability is needed to reach over crater rims, to lift the vehicle out of dugin conditions, to walk over rock strewn areas and to climb steep grades. The conventional wheel rotation capability is primarily needed for speed and comfort of ride over smooth regions. A simultaneous combination of both forms of locomotion seems to be most suitable for the type of terrain in which the operator controls the precise amount of each. Consequently, a particular design of a lunar surface transportation vehicle is outlined. Dissert. Abstr.

N72-25286 Catholic Univ. of America, Washington, D.C.
LABORATORY MODEL RELEVANT TO A STEADY-STATE MATURE HURRICANE Ph.D. Thesis
Chao-Mei Chen 1971 108 p
Avail: Univ. Microfilms Order No. 71-25028

Three dimensional realistic flow phenomena simulating a mature hurricane in its steady state are observed in a laboratory model. The model is constructed of transparent plexiglas in the form of a cylindrical chamber with a large diameter-to-height ratio to obtain the geometric similarity of the real hurricane. It is equipped with ring-shaped heat sources which produce strong ring-shaped convections similar to cumulus convective motions at the eyewall of the mature hurricane. Temperature distribution produced by these ring heat sources closely resembles the distribution of the convectively unstable equivalent potential temperature observed. The model is rotated at a constant speed to simulate the Coriolis effect due to earth rotation. Air is the fluid medium, and smoke is used to trace out the flow patterns.
Dissert. Abstr.

N72-25287* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW MASS TRUSS STRUCTURE Patent
Donald R. Rummler, inventor (to NASA) Issued 30 May 1972 6 p Filed 28 Apr. 1970 Supersedes N70-35638 (08 - 19, p 3522)
(NASA-Case-LAR-10546-1; US-Patent-3,665,670; US-Patent-Appl-SN-32664; US-Patent-Class-52-648; US-Patent-Class-52-655; US-Patent-Class-287-54A) Avail: US Patent Office CSCL 14B

A low-mass truss structure is described with a plurality of angular disposed elongated thin-walled tubular segments. These segments are connected to a plurality of joint clusters forming a unitary truss structure. Official Gazette of the U.S. Patent Office

N72-25288* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVICE FOR MEASURING BEARING PRELOAD Patent
Newton G. Tiller, inventor (to NASA) Issued 30 May 1972 7 p Filed 16 Jul. 1970 Supersedes N70-35536 (08 - 19, p 3522)
(NASA-Case-MFS-20434; US-Patent-3,665,758; US-Patent-Appl-SN-55534; US-Patent-Class-73-140; US-Patent-Class-73-161) Avail: US Patent Office CSCL 14B

A device is described for measuring the thrust preload applied by spring washers against bearings mounted on the rotatable armature shaft of a high-speed motor. The assembly containing the motor is a ventilation fan assembly rigidly mounted on a frame opposite a load cell. The exposed end of the rotatable shaft is aligned with and coupled to a rod extending to the load cell. The load cell is forced away from the fan assembly enough to slightly displace the rotatable shaft axially and thereby apply additional pressure against the spring washer exerting the bearing preload. The amount of shaft displacement is read from a dial indicator and the load applied to the shaft is read from a recorder connected to the load cell. The bearing preload is computed from the force-displacement quantities. Official Gazette of the U.S. Patent Office

N72-25289*# Baganoff Associates, Inc., St. Louis, Mo.
REDUCTION OF SKYLAB 2 GROUND WINDS Annual Report, 8 Apr. 1971 - 7 Apr. 1972
Michael J. Rolfes 5 Apr. 1972 52 p
(Contract NAS8-26703)
(NASA-CR-123671; Rept-605) Avail: NTIS CSCL 14B

A dampometer was designed and fabricated for measuring the amount of damping in the wind tunnel test model. The ground winds data reduction system (GWDRS) was taken to Langley Research Center in support of wind tunnel tests on the Skylab 2 program. Final data reduction of the test results was accomplished by the GWDRS. Author

N72-25290*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF THE FLOW IN A 1-MJ ELECTRIC-ARC SHOCK TUNNEL
John O. Reller, Jr. and N. M. Reddy Washington Jun. 1972 29 p refs
(NASA-TN-D-6865; A-4341) Avail: NTIS HC $3.00 CSCL 14B

In the electric-arc-heated shock tunnel, the facility performance over a range of shock Mach numbers from 7 to 19 was evaluated. The efficiency of the arc-heated driver is deduced using an improved form of the shock tube equation. A theoretical and experimental analysis is made of the tailored-interface condition. The free stream properties in the test section, with nitrogen as the test gas, are evaluated using a method based on stagnation point, heat transfer measurements. Author

N72-25291# Atomic Energy Commission, Washington, D.C.
NATIONAL ACCELERATOR LABORATORY, BATAVIA, ILLINOIS, ENVIRONMENTAL STATEMENT
Dec. 1971 56 p refs
(WASH-1505) Avail: NTIS

The need for this project and the site and facilities of the project itself are described. Social, economic, and physical impact on the environment is discussed, with emphasis on the

impact of radiation. It is concluded that the benefits from the project far outweigh the minor detrimental effects, such as levels of radiation generated and the minor use of the area's natural resources. It is, therefore, proposed that the project be completed and operated as planned. NSA

N72-25791*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRA-PRECISE ATTITUDE TEST FACILITY FOR FLIGHT SPACECRAFT
E. J. Devine *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 148-151 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-25292* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO PHASE FLOW SYSTEM WITH DISCRETE IMPINGING TWO-PHASE JETS Patent
David G. Elliott and Lance G. Hays, inventors (to NASA) Issued 7 Mar. 1972 5 p Filed 21 Oct. 1970 Supersedes N72-13260 (10 - 04, p 0466) Sponsored by NASA
(NASA-Case-NPO-11556; US-Patent-3,648,083; US-Patent-Appl-SN-82648; US-Patent-Class-310-11; US-Patent-Class-210-188) Avail: US Patent Office CSCL 20D

A flow system with discrete two-phase nozzles is described. The two-phase jets produced in the nozzles are made to impinge upon one another in a mixing channel, resulting in coalescence of the liquid into a stream in the center of the channel, with the gas in the jet being forced to the periphery of the liquid stream.
Official Gazette of the U.S. Patent Office

N72-25293 Rice Univ., Houston, Tex.
HYDRODYNAMIC FORCES ON AN OSCILLATING CIRCULAR CYLINDER WITH A PAIR OF TRAILING VORTICES DEVELOPED BEHIND THE CYLINDER Ph.D. Thesis
Thomas Erling Schellin 1971 100 p
Avail: Univ. Microfilms Order No. 71-26352

Hydrodynamic forces were determined on an oscillating circular cylinder, as a pair of trailing vortices developed during the accelerating part of each new half-cycle and detached themselves, becoming free vortices at the end of the decelerating part of each half-cycle. The energy lost to the flow per half-cycle of cylinder oscillation was determined from the two-dimensional flow field surrounding the cylinder, and from this lost energy were determined the hydrodynamic force coefficients. The hydrodynamic forces on the oscillating cylinder can be calculated from the coefficients. Dissert. Abstr.

N72-25294 Ohio State Univ., Columbus.
AN ANALYTICAL STUDY OF SUBSONIC INVISCID FLOW IN DIFFUSERS AND DUCTS OF VARYING CROSS SECTION Ph.D. Thesis
Kervyn Duane Mach 1971 205 p
Avail: Univ. Microfilms Order No. 71-27515

An analytical procedure for predicting the subsonic flow of an inviscid fluid through a duct of arbitrary cross section, such as an aircraft inlet diffuser, has been developed. The procedure is fully three dimensional and is based on the Lax-Wendroff finite difference form of Euler's equations of motion in cylindrical coordinates. A change of dependent variables and a coordinate transform are performed to obtain a first order nonlinear vector differential equation and transform the duct boundary into a cylinder. The differential equation is integrated numerically in the downstream direction, yielding a detailed picture of the flow field at each axial station. Dissert. Abstr.

N72-25295 Rice Univ., Houston, Tex.
AN EXPERIMENTAL INVESTIGATION OF NONEQUILIBRIUM CORNER EXPANSION FLOWS OF DISSOCIATED OXYGEN GENERATED IN A GLOW DISCHARGE SHOCK TUBE Ph.D. Thesis
Alvin John Sustek, Jr. 1971 67 p
Avail: Univ. Microfilms Order No. 71-26363

An experimental investigation of a nonequilibrium corner expansion flow of dissociated oxygen produced in a glow discharge shock tube was carried out in the plasma facility. The flow was generated by a plane shock wave moving through and entraining partially dissociated oxygen, which in turn passes over a 20 degree corner on a mild steel wedge. The study consisted of density measurements obtained with a Mach-Zehnder laser interferometer coupled with an extremely high speed electromechanical shutter. Detailed density results and wave head and tail measurements are presented. Performance characteristics of the glow discharge shock tube and the shutter device are also discussed. Dissert. Abstr.

N72-25296 California Inst. of Tech., Pasadena.
AN INVESTIGATION OF A TWO-DIMENSIONAL PROPULSIVE LIFTING SYSTEM Ph.D. Thesis
Carl Alvin Shollenberger 1971 121 p
Avail: Univ. Microfilms Order No. 71-27109

Several aspects of the nonhomogeneous flow associated with a system combining lifting and propulsive requirements of an aircraft are considered in detail by analytical and experimental methods. The principles governing flow with energy addition are examined. Basic equations and boundary conditions are developed for the complete inviscid and incompressible analysis for the two-dimensional case. The corresponding flow singularities are discussed and the integral equations which completely specify the system are derived. The two special cases of small and large energy addition are considered in detail including solutions. A numerical procedure is developed to solve the full problem including allowance for the wake deflection. Appropriate vorticity forms are used to represent the entire system. An iterative scheme is presented which rapidly converges to a solution for the magnitude and location of the system vorticity distributions. Forces and moments are evaluated on the propulsive lift system.
Dissert. Abstr.

N72-25297 Wisconsin Univ., Madison.
DROPLET FLUID MECHANICS Ph.D. Thesis
Francisco Lee Sy 1971 208 p
Avail: Univ. Microfilms Order No. 71-20695

Flow behavior of drops or bubbles moving through a quiescent liquid under the influence of gravitational force was studied both theoretically and experimentally. Greatest emphasis was put on the determination of transient behavior under creeping flow conditions and of the steady state drag coefficient and drop eccentricity at high Reynolds numbers. The unsteady state rise of both gas bubbles and liquid drops under creeping flow conditions is described by integration of the equation of motion and continuity, and the problem of determining low Reynolds number droplet deformation is discussed. A first order approximate description of the effect of drop eccentricity on drag coefficient at high Reynolds numbers was obtained by use of boundary layer techniques and inviscid flow theory. The effects of Reynolds number and fluid properties on drop eccentricities were studied experimentally by a shadowgraph technique.
Dissert. Abstr.

N72-25298 California Inst. of Tech., Pasadena.
EXPERIMENTAL INVESTIGATION OF THE EFFECT OF COOLING ON NEAR WAKE OF CIRCULAR CYLINDER AT MACH NUMBER SIX Ph.D. Thesis

Mathagondapally A. Ramaswamy 1971 153 p
Avail: Univ. Microfilms Order No. 71-26129

Mean flow properties were determined from Pitot pressure, static pressure, and hot-wire recovery temperature measurements at free stream Reynolds number of 0.905 X 10,000 and 2.95 X 10,000 for both adiabatic and cooled models, the latter at 0.19 t sub 0. The near-wake was laminar for the adiabatic model at both the Reynolds numbers tested. For the cold model, the near-wake was laminar for the lower Reynolds number and transition occurred in the near wake at the higher Reynolds number. The wake shocks, the shear layer edge and the thermal layer edge moved closer to the wake centerline with cooling and with increase in Reynolds number. The base pressure decreased with cooling and the sonic point moved closer to the model on cooling. In the recirculating region, the total temperature distributions exhibited a minimum close to the dividing stream line for all the cases, and the total temperature on the centerline was nearly constant and equal to the value at the real stagnation point (0.5 T sub 0 for the cold models) indicating that the heat transfer in this region was mainly by convection. Dissert. Abstr.

N72-25299 Waterloo Univ. (Ontario). Solid Mechanics Div.
THERMAL INSTABILITY IN DIFFERENTIALLY HEATED INCLINED FLUID LAYERS: A GENERALIZATION OF THE BUOYANCY DRIVEN STATIONARY INSTABILITY
T. E. Unny Jun. 1970 28 p refs Sponsored by Natl. Res. Council of Can.
(Rept-44) Avail: Issuing Activity

In an inclined, adversely heated fluid layer confined between two rigid boundaries in a slot of large aspect ratio, it was found that the unicellular base flow in the conduction regime becomes unstable with the formation of stationary secondary rolls with their axes along the line of inclination (x-rolls) for large Prandtl number fluids and axes perpendicular to the line of inclination (y-rolls) for small Prandtl number fluids. However, for angles near the vertical, the curve of the critical Rayleigh number versus inclination for x-rolls rises above that for y-rolls, so that in a vertical fluid layer, only cross rolls (y-rolls) could develop. The stability equations, as well as the results, reduce to those available for the horizontal fluid layer for which x-rolls are as likely to occur as y-rolls. It was observed that even a small inclination to the horizontal is enough to assign a definite direction to these two-dimensional cells, the direction depending on the Prandtl number. Author

N72-25300 Waterloo Univ. (Ontario). Solid Mechanics Div.
POTENTIAL FLOW OF A VORTEX ROW WITH STATISTICALLY VARYING SPACINGS
E. J. Legerer and U. Lemmin Sep. 1971 16 p refs Submitted for publication
(Rept-94) Avail: Issuing Activity

Potential flow is considered resulting from the superposition of a parallel flow and the flow induced by a vortex row with statistically varying spacings. The expected velocity field is computed. Numerical examples show that a statistical variation of the spacing is only in the near field of the singularities of practical importance. These considerations form a first step towards estabilishing an analysis of tolerances in manufacturing cascades of real profiles. Author

N72-25301*# Dynamic Science, Irvine, Calif.
TRANSPIRATION AND FILM COOLING BOUNDARY LAYER COMPUTER PROGRAM. VOLUME 2: COMPUTER PROGRAM AND USER'S MANUAL Final Report
Roger J. Gloss Jun. 1971 147 p refs
(Contract NAS7-791)
(NASA-CR-126728; SN-230-Vol-2) Avail: NTIS HC $9.50 CSCL 20M

A finite difference turbulent boundary layer computer program which allows for mass transfer wall cooling and equilibrium chemistry effects is presented. The program is capable of calculating laminar or turbulent boundary layer solutions for an arbitrary ideal gas or an equilibrium hydrogen oxygen system. Either two dimensional or axisymmetric geometric configurations may be considered. The equations are solved, in nondimensionalized physical coordinates, using the implicit Crank-Nicolson technique. The finite difference forms of the conservation of mass, momentum, total enthalpy and elements equations are linearized and uncoupled, thereby generating easily solvable tridiagonal sets of algebraic equations. A detailed description of the computer program, as well as a program user's manual is provided. Detailed descriptions of all boundary layer subroutines are included, as well as a section defining all program symbols of principal importance. Instructions are then given for preparing card input to the program and for interpreting the printed output. Finally, two sample cases are included to illustrate the use of the program. Author

N72-25302# Royal Aircraft Establishment, Farnborough (England).
A SIMPLE METHOD OF MEASURING MIST DROPLETS BY SIZE AND NUMBER
J. K. Kaeuffl Dec. 1971 47 p refs Transl. into ENGLISH from the Swedish report FFA-Memo-77
(RAE-Lib-Trans-1627; BR28698; FFA-Memo-77) Avail: NTIS HC $4.50

The drops are separated according to size by sedimentation in a tank of mineral oil. By illuminating the sedimentation tank through a narrow slit, it is possible to infer the weight of water G = f(t) which crosses the plane of the light each second from the light which is diffusely scattered by the drops. By relating the instantaneous values G(t) to the integral of this function and taking the two zero crossovers as limits representing the total injected quantity of water, a simple conversion yields a spectrum which represents the percentage of the number and/or weight of the total number of drops, as a function of intervals of diameter. The accuracy of this method is examined and compared with other measurements. The method is suitable for droplets from about 5 to 1000 microns, giving an accuracy of + or -2.5% for droplets of 150 microns. Author

N72-25303*# Scientific Translation Service, Santa Barbara, Calif.
SOLUTION OF THE CHAPLYGIN EQUATION BY THE METHOD OF STRAIGHT LINES
I. Biybosunov and A. Ryskulov Washington NASA May 1972 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 5, Sep. - Oct. 1971 p 56-64
(Contract NASw-2035)
(NASA-TT-F-14254) Avail: NTIS HC $3.00 CSCL 12A

The method of straight lines is used to solve the Chaplygin equation. This solution describes gas flow at high subsonic velocity about a profile with a local supersonic zone bounded by a curved shock. Author

N72-25304# Grumman Aerospace Corp., Bethpage, N.Y.
SPHERICAL SOURCE FLOW WITH A FINITE BACK PRESSURE
J. Brook and B. Hamel (Drexel Univ.) May 1972 62 p refs Submitted for publication Sponsored by Navy Dept. (Proj. Squid)
(RE-427J) Avail: NTIS HC $5.25

The interaction of a hypersonic spherical source flow with a rarefied background is investigated using the Boltzmann equation with model collision terms. Employing multifluid descriptions of the flow, it is found that two length scales are important in describing the interaction as the background becomes increasingly rarefied. Matched asymptotic expansions of the variables in the two regions are developed, and first order composite solutions constructed. These solutions describe the transition away from the perfect vacuum limit of the expanding flow. Author

N72-25305*# Lockheed Missiles and Space Co., Huntsville, Ala.
ORIFICE IN-FLOW EFFICIENCY TESTS. VOLUME 1:

TEST RESULTS. VOLUME 2: APPLICATION TO SHUTTLE VENTING DURING ENTRY
J. Haukohl, J. L. Forkois, and S. J. Robertson Mar. 1972 274 p refs
(Contract NAS8-26464)
(NASA-CR-61383) Avail: NTIS HC $15.75 CSCL 20D

An investigation was made of the capability for computing internal pressures throughout flight for compartments located within space shuttle vehicles. A test program was conducted at a 6 x 6 foot supersonic wind tunnel to determine orifice efficiencies for the flow of air into a compartment from a flowing external stream. Measurements were made over a Mach number range of 0.7 to 1.9 for varying orifice geometry, vent orientation, vent plate thickness, flat plate boundary layer thickness, and pressure ratio across the vent plate. A computer program developed for outflow venting was modified for use in computing compartment pressures for inflow conditions. Results from both the outflow and inflow computer programs are included. A user's manual and program listing of the inflow venting program are also included. Author

N72-25306*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ACCUMULATOR Patent Application
Luther B. Powers, James A. Long, and Emmett B. Jonds, inventors (to NASA) Filed 4 May 1972 10 p
(NASA-Case-MFS-10354-2; US-Patent-Appl-SN-250335) Avail: NTIS HC $3.00 CSCL 20D

The invention is a device for suppressing pressure oscillations in a fluid transmission line. The device includes a coupling cap connected directly into the fluid line and the cap has a cross-sectional area considerably larger than that of the fluid line. A bellows and housing are mounted on the coupling cap so as to define two separate volumes, an external and internal volume. The internal volume is formed by the coupling cap and the interior of the bellows, and this volume is directly connected to the fluid line. The external volume (the space between the exterior of the bellows and the housing) is either pressurized and sealed off, or connected to a source of pressure so that a selected pressure load can be applied to the exterior surface of the bellows. The bellows will stroke, i.e. expand and contract, in response to pressure fluctuations in the fluid line in a compensating manner which suppresses (damps out) these oscillations. NASA

N72-25307*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS AND METHOD FOR GENERATING LARGE MASS FLOW OF HIGH TEMPERATURE AIR AT HYPERSONIC SPEEDS Patent Application
Alexander P. Sabol and Roger B. Stewart, inventors (to NASA) Filed 9 Mar. 1972 15 p
(NASA-Case-LAR-10612-1; US-Patent-Appl-SN-233173) Avail: NTIS HC $3.00 CSCL 20D

High temperature, high mass air flow, and a high Reynolds number test air flow in the Mach number 8 to 10 regime of adequate test flow duration is attained by pressurizing a ceramic-lined storage tank with air to a pressure of about 100 to 200 atmospheres. The method comprises an elongated ceramic-lined storage tank having an inlet and an outlet, means for supplying air under pressure to the tank through the inlet, electric arc heating means for heating the air prior to its introduction into the tank, a Mach number 8 to 10 hypersonic nozzle as the outlet for discharging the heated and pressurized air, and a means for supplying nitrous oxide near the inlet to supply the heated air. NASA

N72-25308*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SUPPLEMENT TO THE ICRPG TURBULENT BOUNDARY LAYER NOZZLE ANALYSIS COMPUTER PROGRAM
Satoaki Omori and Klaus Gross, W. 17 May 1972 289 p refs
(NASA-TM-X-64663) Avail: NTIS HC $16.50 CSCL 20D

A supplement is presented for a turbulent boundary layer nozzle analysis computer program. It describes the program calculation sequence and presents a detailed documentation of each subroutine. Important equations are derived explicitly, and improvements to the program are discussed. Author

N72-25309*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLUME BACKSCATTER MEASUREMENTS USING QUARTZ CRYSTAL MICROBALANCES IN JPL MOLSINK (MOLECULAR SINK)
Wolfgang Simon 15 May 1972 25 p refs
(Contract NAS7-100)
(NASA-CR-126967; JPL-TM-33-540) Avail: NTIS HC $3.25 CSCL 20M

Quantitative evidence of gas flows in the far upstream region of small nozzles with large boundary layer flow are discussed. Gas mass fluxes were measured using quartz crystal microbalances. Both nitrogen and carbon dioxide gases were used as test gases. Gas deposition rates on the order of 100 monolayers per minute were detected 13 inches upstream of the nozzle exit plane. It is significant to note that the crystals detected gases considerably beyond the Prandtl-Meyer turning angle. The data from these tests will be essential in the formulation of scaling laws and analytical prediction methods for viscous plume behavior. Author

N72-25310# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
HEAT TRANSFER IN HYPERSONIC TURBULENT SEPARATED FLOW
G. T. Coleman and J. L. Stollery Mar. 1972 35 p refs
(IC-Aero-72-05) Avail: NTIS HC $3.75

A study of heat transfer rate in hypersonic turbulent separated flow was made using a wedge compression corner model in a gun tunnel. The results are complementary to surface pressure measurements made in the same facility. Data confirming the rise of heat transfer rate in a region of separation are presented. Author

N72-25311# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
AN EXTENSION OF THE LEES-REEVES-KLINEBERG METHOD TO TWO AND THREE DIMENSIONAL BOUNDARY LAYERS WITH ARBITRARY WALL COOLING RATIO
M. P. Georgeff Feb. 1972 84 p refs
(IC-Aero-72-03) Avail: NTIS HC $6.25

The integral method of Lees-Reeves-Klineberg was extended to allow the study of viscous interaction phenomena over a continuous range of wall cooling ratio. By normalizing the required profile quantities the dependence on wall cooling ratio was removed, thus simplifying the method and allowing flows with variable wall cooling ratio to be studied. Good agreement was obtained when comparisons were made with other theoretical results and experiments. A further extension of the method was developed to include three-dimensional boundary layers with heat transfer and transverse velocity component. Author

N72-25312# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
A COMPARISON OF INTEGRAL METHODS FOR THE PREDICTION OF LAMINAR BOUNDARY LAYER SHOCK WAVE INTERACTION
M. P. Georgeff Jan. 1972 56 p refs
(IC-Aero-72-01) Avail: NTIS HC $5.00

A number of integral methods are compared, which are based on the Lees-Reeves-Klineberg formulation for predicting the characteristics of laminar boundary layer-shock wave interactions. It was found that the methods in which the velocity and enthalpy profiles are described independently provide a powerful means for determining the important characteristics of the interaction. It is also shown that the stability of the governing differential equations (subcritical and supercritical

behavior) is a property of the formulation of the problem and that an explicit relationship between the velocity profile parameter and local pressure gradient does not prevent good agreement with experiment. Author

N72-25313# Transportation Systems Center, Cambridge, Mass.
AIRCRAFT WAKE VORTEX SENSING SYSTEMS
D. Burnham, M. Gorstein, J. N. Hallock, R. Kodis, T. Sullivan, and I. G. McWilliams 30 Jun. 1971 65 p refs
(DOT/TSC Proj. R-2106; DOT-IA-FA-205)
(DOT-TSC-FAA-72-13) Avail: NTIS HC $5.25

Active and passive techniques are analyzed that could be used to detect and measure air movements associated with wingtip vortex generation within an area or throughout a volume of terminal airspace. Usable techniques are indicated with an appraisal of expected performance and inherent limitations. Results of preliminary feasibility tests employing available technology are presented. The systems studies to be performed on the wake vortex sensing problem are discussed. The major effort is directed toward the location of wake vortex hazard, and the generation of monitoring requirements for safe operation in the airport terminal environment. Author

N72-25314# Cambridge Univ. (England).
CALCULATION OF THE ANNULUS WALL BOUNDARY LAYERS IN AXIAL FLOW TURBOMACHINES
J. H. Horlock, and D. Hoadley (Central Elec. Generating Board) London ARC 1972 22 p refs Supersedes ARC-31955
(ARC-CP-1196; ARC-31955) Avail: NTIS; HC $3.25; HMSO 38p; PHI $1.75

An integral method for calculating the turbulent wall boundary layers in axial flow turbomachines is described. The method is applied to flow through annular cascades and single and multistage machines. Agreement between prediction and experiment is good provided lift coefficients and flow deflections of the blade rows are small. Author (ESRO)

N72-25315# Liverpool Univ. (England). Div. of fluid Mechanics.
FLOW IN A SUPERSONIC JET EXPANDING FROM A CONVERGENT NOZZLE
J. C. Gibbings, J. Ingham, and D. Johnson London ARC 1972 37 p refs Supersedes ARC-30371
(ARC-CP-1197; ARC-30371) Avail: NTIS; HC $4.00; HMSO 60p; PHI $2.55

The flow field of an axisymmetric supersonic jet expanding from a circular convergent nozzle into a stationary atmosphere was determined experimentally and compared with a simple analysis and existing analytical results. ESRO

N72-25316# Manchester Univ. (England). Dept. of the Mechanics of Fluids.
VIBRATIONAL EQUILIBRIUM CALCULATIONS OF PROPERTIES BEHIND REFLECTED SHOCK WAVES WITH TABLES FOR CARBON DIOXIDE AND NITROUS OXIDE
R. J. Hine London ARC 1971 11 p refs Supersedes ARC-31421
(ARC-CP-1201; ARC-31421) Avail: NTIS; HC $3.00; HMSO 20p; PHI $0.95

Vibrational equilibrium conditions behind a reflected shock wave are calculated for carbon dioxide and nitrous oxide. Based on a Rayleigh-line method, vibrational relaxation regions in shock waves are analyzed by treating the ideal gas with constant specific heats with heat extraction. A computer program developed for compiling tables of equilibrium conditions behind normal shock waves was adapted to shock waves reflected from a plane wall. Tables of equilibrium conditions for carbon dioxide and nitrous oxide are presented. ESRO

N72-25317# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Heterogene Stroemungen.
A THEORETICAL INVESTIGATION ON LAMINAR INCOMPRESSIBLE BOUNDARY LAYER AND HEAT TRANSFER ON A WAVE-SHAPED WALL
Shinji Hayama 1971 38 p refs
(DLR-FB-71-107) Avail: NTIS HC $4.00; DFVLR, Porz: 10,50 DM

A theoretical investigation was carried out on the laminar incompressible boundary layer and heat transfer on a wave-shaped wall. A nondimensional stream function was expressed as power series of a small parameter which represents the ratio of amplitude to wave length of a wave-shaped wall. The first order coefficient function for the stream function was expanded into power series of a nondimensional variable which represents the distance along the wall, and universal coefficient functions were obtained. The same method was also used to obtain the first order coefficient function for the temperature profile on a wave-shaped wall, and universal functions for the temperature profile were obtained. The differential equations for these universal functions, were solved and a first order analytical solution for the boundary layer and heat transfer on a wave-shaped wall was obtained. Author (ESRO)

N72-25318# Illinois Inst. of Tech., Chicago. Dept. of Mechanical and Aerospace Engineering.
ON THE RESPONSE OF LAMINAR BOUNDARY LAYERS TO PERIODIC CHANGES IN FREE-STREAM SPEED Interim Report
Mark V. Morkovin, Richard I. Loehrke, and Andrew A. Fejer Aug. 1971 55 p refs
(Contract F44620-69-C-0022; Grant NSF GK-1903; AF Proj. 9560)
(AD-737856; IIT-THEMIS-71-2-Aug-71; AFOSR-71-2317TR) Avail: NTIS CSCL 20/4

An account is made of the cumulative experiences in an oscillating-flow wind tunnel concerning the direct forced response of laminar boundary layers to free-stream oscillations. The theory and experiment provide a level of confidence in the concepts. The existence of a periodic, jet-like phenomenon in a downstream-facing locally separated region was confirmed for amplitudes above an ill-defined threshold. By seeding controlled disturbances at arbitrary times and locations in the boundary layer a dichotomy in transition correlation is clarified. GRA

N72-25319# Admiralty Research Lab., Teddington (England).
THE EFFECT OF TEMPERATURE ON DRAG REDUCTION EFFECTIVENESS OF POLYOX AND OF POLYACRYLAMIDE
E. W. A. Pike Jul. 1971 4 p refs
(AD-738255; ARL/C/N9; TRC-BR-27989) Avail: NTIS CSCL 20/4

Solutions in tap water of three commercial polymers were examined for pipe flow drag reduction, measured by determination of skin friction coefficient over an eleven foot length of pipe. GRA

N72-25320# Illinois Inst. of Tech., Chicago. Dept. of Mechanical and Aerospace Engineering.
VISUALIZATION OF UNSTEADY FLOW OVER OSCILLATING AIRFOILS
George H. Ruiter, Hassan M. Nagib, and Andrew A. Fejer Sep. 1971 39 p refs Presented at Symp. on Turbulence Measurements in Liquids, 2d, Rolla, Mo., 1971
(Contract F44620-69-C-0022; Grant NSF GK-17748; AF Proj. 9560)
(AD-738304; IIT-THEMIS-R71-6; AFOSR-72-0076TR) Avail: NTIS CSCL 20/4

The study is concerned primarily with the complex nature of leading edge flow separation occurring on airfoils oscillating in a uniform flow field at low Reynolds numbers. The flow field past an oscillating airfoil and a fixed airfoil with an oscillating flap were investigated using various visualization techniques in water. The role of mean flow velocity, instantaneous angle of attack, mean angle of attack and amplitude and frequency of oscillation as well as the location of the support point are examined. The

results which were obtained over a range of parameters substantially beyond previous studies include new information regarding the effect of these parameters on the nature and onset of separation. GRA

N72-25321# Aeronautical Research Associates of Princeton, Inc., N.J.
EXPERIMENTAL STUDY OF TRANSITION INDUCED IN AN ACCELERATED BOUNDARY LAYER AT LOW REYNOLDS NUMBERS
Richard S. Snedeker Oct. 1971 73 p refs
(Contract F44620-71-C-0004; AF Proj. 9781)
(AD-738335; ARAP-168; AFOSR-71-3106TR) Avail: NTIS CSCL 20/4

The response of a highly accelerated laminar boundary layer to disturbances introduced by a vibrating ribbon is described. The boundary layer was formed on a flat plate under the influence of a pressure gradient equal to that occurring at a two-dimensional stagnation point. The range of initial test Reynolds numbers was 492 to 805, and the range of nondimensional disturbance frequencies (Strouhal number) was .03 to .20. The qualitative effects of disturbances from extraneous sources are discussed, and some observations of the detailed motion of the vibrating ribbon are described. GRA

N72-25322# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
MATHEMATICAL MODELLING OF NORMAL IMPACT BETWEEN A FINITE CYLINDRICAL LIQUID JET AND NON-SLIP FLAT RIGID SURFACE
Yen C. Huang, F. G. Hammitt, and Wen-Jei Yang Oct. 1971 21 p refs
(Contract NSF GK-730)
(PB-206912; UMICH-03371-13-T) Avail: NTIS CSCL 20D

When a cylindrical free jet of water is directed against a rigid smooth wall, the jet is deflected into lateral flow parallel to the wall away from the point of impact. However, at the first instant of impact, the sudden change of boundary velocity will establish large pressure gradients, which later produce a sudden change in the velocity at every point of the fluid. The environment leading to a destructive action due to the cylindrical jet impingement at high speed was investigated analytically. GRA

N72-25497# Queens Univ., Belfast (Northern Ireland).
EFFECTS OF COHERENCE ON FLOW VISUALIZATION METHODS
L. H. Tanner *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 2 p (See N72-25493 16-16)
Avail: NTIS HC $14.50

N72-25503# Institut Franco-Allemand de Recherches, St. Louis (France).
LASER BEAM PROBING FOR AERODYNAMIC FLOW FIELD ANALYSIS
Bernard Koch *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 20 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-25323* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ATMOSPHERIC SAMPLING DEVICES Patent
James E. Lovelock and Peter G. Simmonds, inventors (to NASA) Issued 16 May 1972 8 p Filed 15 Oct. 1970 Supersedes N72-13306 (10 - 04, p 472) Sponsored by NASA
(NASA-Case-NPO-11373; US-Patent-3,662,604; US-Patent-Appl-SN-81095; US-Patent-Class-73-421.5R; US-Patent-Class-73-422GC; US-Patent-Class-73-422TC) Avail: US Patent Office CSCL 04A

An atmosphere sampling chamber is described. The chamber has an inlet communicating with the atmosphere to be sampled and an outlet communicating with an analysis device such as a gas chromatograph. The annulus in the container adjacent the outer walls of the chamber contains a fluid medium for pressurizing the chamber to exhaust its contents through the outlet. In one embodiment, the chamber is a gas-impervious bellows which is exhausted by feeding gas to the container. In another embodiment, the chamber is formed of a hydrogen-permeable palladium alloy tube and the fluid medium is an electrolyte capable of transporting an ionic species of hydrogen.
Official Gazette of the U.S. Patent Office

N72-25324 Rice Univ., Houston, Tex.
ROCKET-BORNE MAGNETOMETER MEASUREMENT OF FIELD-ALIGNED CURRENTS ASSOCIATED WITH AN AURORAL ARC Ph.D. Thesis
Raymond John Park 1971 319 p
Avail: Univ. Microfilms Order No. 71-26335

A rocket-borne experiment to study the currents associated with a quiet auroral arc was conducted. The magnetic field near the arc was measured with a vector magnetometer system, while a lunar aspect sensor provided information on the orientation of the payload. The techniques for analyzing the magnetometer data to obtain the vector components of the magnetic field are described. The changes in magnetic field along the flight path were used to determine the most probable three-dimensional current system, which was concluded to be a northwestward electrojet and two oppositely directed sheet currents flowing along the geomagnetic field lines. The electrojet and the planes containing the field-aligned sheet currents were approximately parallel to the auroral arc. Dissert. Abstr.

N72-25325 Rice Univ., Houston, Tex.
THERMAL AND QUASI-ENERGETIC PLASMA FLOW IN THE MAGNETOSPHERE: THEORETICAL STUDY Ph.D. Thesis
Abel Jer-Jiunn Chen 1971 171 p
Avail: Univ. Microfilms Order No. 71-26273

Using a simple computational model with a uniform convection electric field and a dipole magnetic field, the drift paths for a low energy plasma in the magnetosphere are calculated. A detailed study of drift paths and particle loss leads to two important conclusions suggested before on a more qualitative basis. One is that, through enhancement of the convection field, protons convected from the magnetotail to L = 3 - 4 could be responsible for stormtime ring currents. The other is that the asymmetry of the particle trajectories coincides well with the observed asymmetry of the ring currents. Also studied were the formation and morphology of the plasmasphere by the time-dependent convection field. Dissert. Abstr.

N72-25326 New Hampshire Univ., Durham.
ROCKET MEASUREMENTS OF FIELD ALIGNED CURRENTS AND ENERGY SPECTRA OF CHARGED PARTICLES IN AN AURORAL DISPLAY Ph.D. Thesis
Lawrence Wah Choy 1971 149 p
Avail: Univ. Microfilms Order No. 71-25411

A Nike-Tomahawk rocket equipped to measure electric and magnetic fields and charged particles from a few ev to several hundred kev energy was flown into an auroral band from Fort Churchill on 11 April 1970. The particle detectors were oriented so as to measure net field aligned currents. At the region north and away from the auroral band, an upward electron current (electrons going away from earth) has been discovered. This field aligned current consisted of electrons with energies less than 600 ev and had a magnitude which varied from 10 to the minus

8th power to 10 to the minus 7th power amperes per square meter. Dissert. Abstr.

N72-25327 Tennessee Univ., Knoxville.
REMOTE SENSING OF TERRESTRIAL VEGETATION: A COMPREHENSIVE BIBLIOGRAPHY
Paul F. Krumpe Jan. 1972 72 p refs
Avail: Paul F. Krumpe, Forestry Remote Sensing Lab., Calif. Univ., Berkeley, 94720

A comprehensive bibliography, containing more than 850 references, is presented. The bibliography deals with the utilization and application of remote sensing in forestry, agriculture, and plant ecology, as well as closely allied fields, such as land use planning, resource inventory and management, and soils and terrain analysis. In addition, technical background, historical, and data manipulation and analysis references are included. Author

N72-25328 Rice Univ., Houston, Tex.
VECTOR MEASUREMENTS OF THE ION TRANSPORT VELOCITY WITH APPLICATIONS TO F-REGION DYNAMICS Ph.D. Thesis
Richard Alan Behnke 1971 159 p
Avail: Univ. Microfilms Order No. 71-26255

The measurements of vector ion transport velocities in the F-region at Arecibo are presented for several winter days during 1969-1970. To make the vector measurement, first the line of sight plasma motion is determined from the Doppler shift of the returned incoherent scatter spectrum. Next, the radar beam is pointed sequentially toward (geomagnetic) north, west and south. From the three line of sight measurements the transport velocity vector can be reconstructed and studied. Meridional neutral winds in the F-region can be found with a knowledge of the transport velocity component parallel to the magnetic field. The obtained winds show a diurnal pattern that is quite different from theoretical predictions. In particular, the results indicate the presence of an unknown neutral wind driving force that significantly modulates the predicted pattern which is based on worldwide pressure gradients due to solar heating.
Dissert. Abstr.

N72-25329*# Illinois Univ., Urbana. Aeronomy Lab.
DIFFERENTIAL PHASE MEASUREMENTS OF D-REGION PARTIAL REFLECTIONS
D. J. Wiersma and C. F. Sechrist, Jr. 1 Mar. 1972 79 p refs
(Grant NGR-14-005-181)
(NASA-CR-126725; UILU-Eng-72-2502; Aeron-47) Avail: NTIS HC $6.00 CSCL 04A

Differential phase partial reflection measurements were used to deduce D region electron density profiles. The phase difference was measured by taking sums and differences of amplitudes received on an array of crossed dipoles. The reflection model used was derived from Fresnel reflection theory. Seven profiles obtained over the period from 13 October 1971 to 5 November 1971 are presented, along with the results from simultaneous measurements of differential absorption. Some possible sources of error and error propagation are discussed. A collision frequency profile was deduced from the electron concentration calculated from differential phase and differential absorption. Author

N72-25330*# Translation Consultants, Ltd., Arlington, Va.
THE EXTENT OF THE ZONE OF STRONG PITCH ANGLE DIFFUSION OF OUTER ZONE AND PLASMA LAYER ELECTRONS DURING A SUBSTORM
Yu. I. Galperin and N. I. Fedorova Washington NASA May 1972 34 p refs Transl. into ENGLISH from "O Protyazhennosti Zony Silnoy Diffuzi po Pitchuglam Elektronov Vneshney Zony i Plasmennogo Sloya vo Vremya Subburi", Acad. of Sci., Moscow, report D-103, 1971 50 p
(Contract NASw-2038)
(NASA-TT-F-14190; D-103) Avail: NTIS HC $3.75 CSCL 04A

The observance of a weak diffusion condition from low orbit satellite data (Cosmos 261) was based on the recording only of the pitch angle distribution of particles in the plasma layer outside the loss cone. It is concluded that these data cannot be obtained from low altitude measurements. Author

N72-25331# National Physical Lab., New Delhi (India). Radio Science Div.
ELECTRON CONTENT MEASUREMENTS OVER DELHI FROM FARADAY FADING OF SATELLITE EXPLORER-27 (BE-C) TRANSMISSIONS Technical Report, Jun. 1965 - Sep. 1967
Kamlesh Kumari Mittal and Tuhi Ram Tyagi Aug. 1971 21 p
(RSD-66; SR-66; Rept-5) Avail: NTIS HC $3.25

The Faraday fading records of Explorer 27 transmissions on 20, 40 and 41 MHz were taken at the National Physical Laboratory, Delhi from June 1965 to September 1967. The electron content values for this period are given for each satellite pass at the time of closest point of approach (CPA). In addition, satellite zenith angle at CPA, foF2 values deduced from corresponding C4 ionograms recorded at Delhi, solar flux, and magnetic index values are given. Author

N72-25332# RAND Corp., Santa Monica, Calif.
THE USE OF WATER QUALITY SIMULATION MODELS IN THE ANALYSIS OF THE THERMAL EFFECTS PROBLEM
E. C. Gritton, J. Kvitky, and J. J. Leendertse Apr. 1972 7 p refs Presented at 18th Ann. Meeting of Am. Nucl. Soc., Las Vegas, Nev., 18-22 Jun. 1972
(P-4772-1) Avail: NTIS HC $3.00

A water quality simulation model was developed for use in well-mixed estuaries and coastal seas. The model is based on the numerical solution by finite difference techniques of the two-dimensional vertically integrated equations of motion and continuity for a fluid. A heat transport model was incorporated into the water quality simulation model in order to analyze the effect of thermal discharges on aquatic ecosystems. K.P.D.

N72-25333# National Oceanic and Atmospheric Administration, Rockville, Md. Center for Experiment Design and Data Analysis.
THE BOMEX SEA-AIR INTERACTION PROGRAM: BACKGROUND AND RESULTS TO DATE
Joshua Z. Holland Mar. 1972 38 p refs
(NOAA-TM-ERL-BOMAP-9) Avail: NTIS HC $4.00

The Barbados oceanographic and meteorological experiment (BOMEX) sea-air interaction program was directed towards a national effort on the scientific problems of sea-air interaction. It ruled the layout of the ship array, scheduling of observations, and deployment of aircraft during the first three BOMEX observation periods: 3 to 15 May, 24 May to 10 June, and 19 June to 2 July, 1969. It was designed to provide data on the sea-air flux of energy by three methods: (1) measurement of atmospheric budget terms over a 500 km square, (2) direct measurement of surface-layer vertical eddy fluxes at various times and places within the square, and (3) measurement of the major terms of the heat budget of the upper ocean at each of the ship stations. The momentum flux was also to be evaluated by the first two methods. Some estimates of the evaporation rate, stress, sensible heat flux, and kinetic energy flux were obtained by each of the methods. Author

N72-25334*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
OCEANOGRAPHIC SCANNER SYSTEM DESIGN STUDY, VOLUME 1
Oct. 1971 413 p refs
(Contract NASw-2119)
(NASA-CR-126721; BSR-3129-Vol-1) Avail: NTIS HC $22.75 CSCL 08J

The design is reported of a dual mode multispectral scanner, capable of satisfying both overland and oceanographic requirements. A complete system description and performance summary of the scanner are given. In addition, subsystem and

component descriptions and performance analyses are treated in individual sections. The design of the scanner, with minimum modifications, interfaces to the ERTS spacecraft and the ground data handling system. D.L.G.

N72-25335*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
OCEANOGRAPHIC SCANNER SYSTEM DESIGN STUDY, VOLUME 2
Oct. 1971 49 p
(Contract NASw-2119)
(NASA-CR-126722; BSR-3129-Vol-2) Avail: NTIS HC $4.50 CSCL 08J

Breadboard tests of the scanner system were conducted and the results obtained are described. The findings reported include those from tests on the optics system, scan mechanism hardware, and the electronics system. In addition, various alternative configurations are discussed and the alignment tolerances are analyzed. D.L.G.

N72-25336*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ATMOSPHERIC PRESSURE, DENSITY, TEMPERATURE AND WIND VARIATIONS BETWEEN 50 AND 200 KM
C. G. Justus and Arthur Woodrum Washington NASA May 1972 81 p refs
(Contract NAS8-26658)
(NASA-CR-2062; E-16-612) Avail: NTIS HC $3.00 CSCL 04A

Data on atmospheric pressure, density, temperature and winds between 50 and 200 km were collected from sources including Meteorological Rocket Network data, ROBIN falling sphere data, grenade release and pitot tube data, meteor winds, chemical release winds, satellite data, and others. These data were analyzed by a daily difference method and results on the distribution statistics, magnitude, and spatial structure of the irregular atmospheric variations are presented. Time structures of the irregular variations were determined by the analysis of residuals from harmonic analysis of time series data. The observed height variations of irregular winds and densities are found to be in accord with a theoretical relation between these two quantities. The latitude variations (at 50 - 60 km height) show an increasing trend with latitude. A possible explanation of the unusually large irregular wind magnitudes of the White Sands MRN data is given in terms of mountain wave generation by the Sierra Nevada range about 1000 km west of White Sands. An analytical method is developed which, based on an analogy of the irregular motion field with axisymmetric turbulence, allows measured or model correlation or structure functions to be used to evaluate the effective frequency spectra of scalar and vector quantities of a spacecraft moving at any speed and at any trajectory elevation angle. Author

N72-25337# Illinois Univ., Urbana. Aeronomy Lab.
A MATHEMATICAL MODEL FOR THE RADON DENSITY DISTRIBUTION IN THE 1-20 KM REGION
D. J. Wuebbles, T. Shimazaki, and C. F. Sechrist, Jr. 1 Jan. 1972 66 p refs
(Grant NSF GA-25660)
(UILU-ENG-72-2501; Aeronomy-46) Avail: NTIS HC $5.50

A one-dimensional model for the vertical diffusion of radon in the region from one to 20 km was developed. The model, which is also applicable to other minor atmospheric constituents, can be used to investigate transport processes in the lower and middle atmosphere. Both time-dependent and time-independent solutions were found to the continuity equation utilizing an implicit numerical technique. Vertical distributions of the radon abundance in the lower atmosphere are presented for several assumed profiles of the eddy diffusion coefficient and for changes in lower and upper boundary conditions. Comparisons are made with the available data. Author

N72-25338# Instituto Geografico y Catastral, Madrid (Spain).
ANNUAL OF THE GEOMAGNETIC AND AERONOMY SERVICE, 1969 [ANUARIOS DEL SERVICO DE GEOMAGNETISMO Y AERONOMIA, ANO 1969]
1971 248 p In SPANISH
Avail: NTIS HC $14.50

The results of systematic measurement of magnetic elements in the geomagnetic field for 1969 are presented. The magnetic activity indices K + C are included along with the rapid variations in the magnetic field. Transl. by F.O.S.

N72-25339*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF MODIFIED THERMAL CONDUCTIVITY ON THE TEMPERATURE DISTRIBUTION IN THE PROTONOSPHERE
H. G. Mayr, Ernest G. Fontheim, and K. K. Mahajan Apr. 1972 13 p refs Submitted for publication
(NASA-TM-X-65900; X-621-72-107) Avail: NTIS HC $3.00 CSCL 03B

At typical protonospheric electron densities, the electron mean free path is long enough that the coefficient of thermal conductivity is no longer given by Spitzer's expression. The effect on the temperature profile of using the corrected expression for conductivity is investigated. The corrected thermal conduction coefficient is density-dependent and has a more complicated temperature dependence than the coefficient applicable to higher density plasmas. The results indicate that the effect is not negligible even under quiet conditions and at low latitudes. Author

N72-25340*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UNIPOLAR INDUCTION IN THE MAGNETOSPHERE
David P. Stern May 1972 38 p refs Submitted for publication
(NASA-TM-X-65893; X-641-72-133) Avail: NTIS HC $4.00 CSCL 03B

A theory is described for the production of electric currents in the magnetosphere and for the transfer of energy from the solar wind to the magnetosphere. Assuming that the magnetosheath has ohmic-type conduction properties, it is shown that unipolar induction can energize several current flows, explaining the correlation of the east-west component of the interplanetary magnetic field with polar electric fields and polar magnetic variations. In the tail region, unipolar induction can account for effects correlated with the north-south component of the interplanetary magnetic field. Author

N72-25341*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METALLIC IONS IN THE EQUATORIAL IONOSPHERE
A. C. Aikin and R. A. Goldberg May 1972 43 p refs
(NASA-TM-X-65891; X-625-72-129) Avail: NTIS HC $4.25 CSCL 04A

Four positive ion composition measurements of the equatorial E region made at Thumba, India, are presented. During the day, the major ions between 90 and 125 km are NO(+) and O2(+). A metallic ion layer centered at 92 km is observed, and found to contain Mg(+), Fe(+), Ca(+), K(+), Al(+), and Na(+) ions. The layer is explained in terms of a similarly shaped latitude distribution of neutral atoms which are photoionized and charge-exchanged with NO(+) and O2(+). Three body reactions form molecular metallic ions which are rapidly lost by dissociative ion-electron recombination. Nighttime observations show downward drifting of the metallic ion layer caused by equatorial dynamo effects. These ions react and form neutral metals which exchange charges with NO(+) and O2(+) to produce an observed depletion of those ions within the metallic ion region. Author

N72-25342*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INTERSTELLAR FORMALDEHYDE AND SILICON MONOXIDE IN ULTRA-DENSE CLOUDS Ph.D. Thesis - Columbia Univ.

Marc Leslie Kutner Jan. 1972 96 p refs

(NASA-TM-X-65897; X-630-72-49) Avail: NTIS HC $7.00 CSCL 04A

The discovery is reported of the 140.8 GHz, 1 sub 11 - 2 sub 12 and 150.5 GHz 1 sub 10 - 2 sub 11 rotational transitions of ortho-formaldehyde and the 146.6-GHz 1 sub 01 - 2 sub 02 transition of para-formaldehyde in the Orion nebula. All lines were observed in emission. The 140.8 GHz line was mapped over a region about 3 x 5 min. in the direction of the Kleinmann-Low IR nebula. It is argued that the excitation is due to collisions with neutral particles. The 140.8 GHz line was also detected in the direction of Sgr A, W3 (OH), W51, DR21 (OH) and NGC 2024. The detection of weak 6 cm H2CO absorption over much of the Orion nebula is also reported. Because the line shows no correlation with the 6 cm continuum, it is attributed to anomalous absorption by H2CO behind the H II continuum source. Author

N72-25343*# Barringer Research Ltd., Rexdale (Ontario).

ABSORPTION SPECTROMETER BALLOON FLIGHT AND IODINE INVESTIGATIONS

Aug. 1970 136 p refs

(Contract NAS9-9492)

(NASA-CR-115639; TR70-148) Avail: NTIS HC $9.00 CSCL 04A

A high altitude balloon flight experiment to determine the technical feasibility of employing absorption spectroscopy to measure SO2 and NO2 gases in the earth's atmosphere from above the atmospheric ozone layer is discussed. In addition to the balloon experiment the contract includes a ground-based survey of natural I emissions from geological sources and studies of the feasibility of mapping I2 from spacecraft. This report is divided into three major sections as follows: (1) the planning engineering and execution of the balloon experiment, (2) data reduction and analysis of the balloon data, and (3) the results of the I2 phase of the contract. Author

N72-25344*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A DETAILED GRAVIMETRIC GEOID FROM NORTH AMERICA TO EURASIA

Samir Vincent (Computer Sci. Corp.), William E. Strange (Computer Sci. Corp.), and James G. Marsh Mar. 1972 30 p refs Presented at Natl. Fall. Meeting of Am. Geophys. Union, San *Francisco, 6-9 Sep. 1971 Submitted for publication*

(NASA-TM-X-65884; X-553-72-94) Avail: NTIS HC $3.50 CSCL 08N

A detailed gravimetric geoid of the United States, North Atlantic, and Eurasia, which was computed from a combination *of satellite derived and surface gravity data, is presented.* The precision of this detailed geoid is + or - 2 to + or - 3 m in the continents but may be in the range of 5 to 7 m *in those areas* where data is sparse. Comparisons of the detailed gravimetric geoid with results of Rapp, Fischer, and Rice for the United States, *Bomford in Europe, and Heiskanen and Fischer in India* are presented. Comparisons are also presented with geoid heights from satellite solutions for geocentric station coordinates *in North America, the Caribbean, and Europe.* Author

N72-25345*# Techtran Corp., Glen Burnie, Md.

THE EOLE PROGRAM

Washington NASA 28 Feb. 1972 32 p Transl. into ENGLISH from "Le Programme Eole", Centre Natl. d'Etudes Spatiales, Paris, France, 1972 31 p

(Contract NASw-2037)

(NASA-TT-F-14279) Avail: NTIS HC $3.75 CSCL 08C

The Eole program is an experimental program to determine the effectiveness of satellite monitoring of drifting buoys and balloons in the Southern Hemisphere. The results of the program thus far are summarized, and the future need and demand for this type of service in determining the position of ships and in collecting and transmitting data of hydrological, oceanographic, and meteorological interest are considered. Author

N72-25346# Advisory Group for Aerospace Research and Development, Paris (France).

NOMENCLATURE OF TERRAIN COLOUR

I. C. Perry (Headquarters Army Aviation Centre, Middle Wallop, Engl.) Mar. 1972 9 p In ENGLISH; partly in FRENCH Original contains color illustrations

(AGARD-AG-159; AGARDograph-159) Avail: NTIS HC $3.00

A simple method by which color may be universally identified is described and illustrated. The system is designed to function as a precise color identification scheme regardless of language translation or individual interpretation. Such a system is important in air-ground communications of aircraft and spacecraft and various other scientific endeavors where exactness is necessary. E.H.W.

N72-25347*# National Academy of Sciences-National Research Council, Washington, D.C. *Panel on Remote Atmospheric* Probing.

ATMOSPHERIC EXPLORATION BY REMOTE PROBES. VOLUME 2: PROCEEDINGS OF SCIENTIFIC MEETINGS OF THE PANEL ON REMOTE ATMOSPHERIC PROBING Final Report

Jan. 1969 710 p refs Conf. held at Chicago, 18-20 Apr. and 16-17 May 1968 Sponsored in part by AEC, ESSA, NSF, and *PHS*

(NASA Order W-12,596)

(NASA-CR-126787) Avail: NTIS HC $37.50 CSCL 04A

Conference papers are presented dealing with methods and instrumentation capable of observing and measuring the physical composition and dynamical structure of the atmosphere from a distance. For individual titles, see N72-25348 through N72-25388.

N72-25348*# Dartmouth Coll., Hanover, N.H. *Radiophysics* Lab.

LINE OF SIGHT MICROWAVE PROPAGATION

John W. Strohbehn In NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 1-20 refs (See N72-25347 16-13)

Avail: NTIS HC $37.50 CSCL 20N

A review of the uses of microwave line-of-sight propagation *in remote atmospheric probing is given. The review concentrates* on use of the following types of measurements: (1) the use of total electrical path length for measuring average density and *water vapor content; (2) the use of amplitude and phase* fluctuations over a single path for determining the form of the turbulence spectrum; (3) the use of angle-of-arrival data for measuring the decrease in refractivity; and (4) the use of multiple-element receiving antennas in determining wind speed, *atmospheric parameters, and atmospheric models. A review is* given of the connection between microwave measurements and meteorological parameters, and the basic electromagnetic theory *on which the analyses are made. A few suggestions for future* work in these areas is given. Author

N72-25349*# Stanford Univ., Calif. Electronics Labs.

WAVE PROPAGATION IN A RANDOM MEDIUM

R. W. Lee and J. C. Harp *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 21-78 *refs* (See N72-25347 16-13)

(Contract F04701-68-C-0110)

Avail: NTIS HC $37.50 CSCL 20N

A simple technique is used to derive statistical characterizations of the perturbations imposed upon a wave (plane, spherical *or beamed) propagating through a random medium.* The method is essentially physical rather than mathematical, and is probably equivalent to the Rytov method. *The limitations of the method*

are discussed in some detail; in general they are restrictive only for optical paths longer than a few hundred meters, and for paths at the lower microwave frequencies. Situations treated include arbitrary path geometries, finite transmitting and receiving apertures, and anisotropic media. Results include, in addition to the usual statistical quantities, time-lagged functions, mixed functions involving amplitude and phase fluctuations, angle-of-arrival covariances, frequency covariances, and other higher-order quantities. Author

N72-25350*# Boeing Scientific Research Labs., Seattle, Wash.
ADDITIONAL LINE OF SIGHT METHODOLOGY TO THAT PRESENTED BY JOHN W. STROHBEHN IN THE USE OF LINE OF SIGHT MICROWAVE PROPAGATION IN REMOTE ATMOSPHERIC PROBING
C. I. Beard *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 79-86 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20N

Some additional microwave and infrared techniques are reported which are being tested in line-of-sight tropospheric scattering. Newly measured parameters of the incoherent scattered microwave field are sensitive to wavefront sphericity, to wind speed, and to the eddy wavenumber spectrum. A recommendation for advancing the state of the art is given by a proposed experimental program. Author

N72-25351*# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE USE OF SATELLITE BEACONS FOR METEOROLOGICAL RESEARCH
Jules Aarons *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 89-90 (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

The use of microwave beacon transmissions from synchronous and near synchronous satellites is discussed as a means of measuring atmospheric absorption. It is suggested that, with a fixed angle of elevation of a synchronous satellite, complete diurnal coverage of the integrated absorption is available. In addition, with refined interferometric equipment, angle of arrival studies can be made and phase deviations measured. D.L.G.

N72-25352*# Environmental Science Services Administration, Boulder, Colo.
REMOTE ATMOSPHERIC PROBING BY GROUND TO GROUND LINE OF SIGHT OPTICAL METHODS
Robert S. Lawrence *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 91-110 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

The optical effects arising from refractive-index variations in the clear air are qualitatively described, and the possibilities are discussed of using those effects for remotely sensing the physical properties of the atmosphere. The effects include scintillations, path length fluctuations, spreading of a laser beam, deflection of the beam, and depolarization. The physical properties that may be measured include the average temperature along the path, the vertical temperature gradient, and the distribution along the path of the strength of turbulence and the transverse wind velocity. Line-of-sight laser beam methods are clearly effective in measuring the average properties, but less effective in measuring distributions along the path. Fundamental limitations to the resolution are pointed out and experiments are recommended to investigate the practicality of the methods. Author

N72-25353*# Michigan Univ., Ann Arbor.
LOCAL ISOTROPY AND REFRACTIVE INDEX FLUCTUATIONS IN THE SURFACE LAYER OF THE ATMOSPHERE
Donald J. Portman *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 111-117 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

Theoretical and experimental evidence for the existence of local isotropy is briefly examined and conflicting results are found. Recent measurements of temperature spectra support earlier hot wire anemometer and optical scintillation measurements that show little evidence of local isotropy at 1 to 1.5 meters over an extensive uniform and level grass covered field. Author

N72-25354*# Ballistic Research Labs., Aberdeen Proving Ground, Md.
OPTICAL PROPAGATION IN A NEAR-EARTH ENVIRONMENT
Paul H. Deitz *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 119-124 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

Optical measurements are described of the magnitude of scintillation as a function of the range and refractive index structure coefficient. The results are compared with the Tatarski and deWolf geometrical optics saturation equations. In addition, a variation in the Kolmogorov turbulence model is suggested to account for certain observed optical and meteorological parameters. Author

N72-25355*# Sylvania Electronic Systems-East, Waltham, Mass.
INCOHERENT AND COHERENT CW LASER SYSTEMS FOR REMOTE ATMOSPHERIC PROBING **c16**
R. F. Lucy *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 125-132 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20E

Typical laser systems now available for atmospheric probing are summarized. Experiments comparing coherent and incoherent receiving techniques are described and typical performance data presented. Author

N72-25356*# Autonetics, Anaheim, Calif. Electro Optical Lab.
REMOTE PROBING OF THE OPTICAL STRENGTH OF ATMOSPHERIC TURBULENCE AND OF WIND VELOCITY
D. L. Fried *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 133-144 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

A procedure for determining the optical strength of turbulence of the atmósphere and the wind velocity at various altitudes by measuring the spatial and temporal covariance of scintillation is developed. Emphasis is placed on the development of the formal relationships that have to be inverted to obtain the desired results. For determination of optical strength of turbulence, it is a linear integral equation that is developed. However, for determination of remote wind velocity, a nonlinear integral equation is obtained. A computer approach for solving each of the equations is suggested. The configuration and performance requirements of the measurement apparatus are discussed. Author

N72-25357*# Stanford Research Inst., Calif.
LIDAR **c16**
R. T. H. Collis *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 147-171 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20E

Lidar is an optical radar technique employing laser energy. Variations in signal intensity as a function of range provide information on atmospheric constituents, even when these are too tenuous to be normally visible. The theoretical and technical basis of the technique is described and typical values of the atmospheric optical parameters given. The significance of these parameters to atmospheric and meteorological problems is discussed. While the basic technique can provide valuable

information about clouds and other material in the atmosphere, it is not possible to determine particle size and number concentrations precisely. There are also inherent difficulties in evaluating lidar observations. Nevertheless, lidar can provide much useful information as is shown by illustrations. These include lidar observations of: cirrus cloud, showing mountain wave motions; stratification in clear air due to the thermal profile near the ground; determinations of low cloud and visibility along an air-field approach path; and finally the motion and internal structure of clouds of tracer materials (insecticide spray and explosion-caused dust) which demonstrate the use of lidar for studying transport and diffusion processes. Author

N72-25358*# New York Univ., N.Y. Geophysical Sciences Lab.
SOME ASPECTS OF REMOTE ATMOSPHERIC SENSING BY LASER RADAR c16
Richard M. Schotland *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 179-200 refs (See N72-25347 16-13)
(Contrib-62) Avail: NTIS HC $37.50 CSCL 20E

An analysis has been made of some aspects of atmospheric sensing by laser radar spectroscopy. A discussion of the laser radar equation is presented which leads to methods for obtaining atmospheric information by spectroscopic means. Calculations are presented which investigate the potential of Doppler, Raman and differential absorption techniques. It is concluded that atmospheric measurements based upon Doppler and Raman approaches are restricted to qualitative studies at the present time primarily because of the limitations imposed by existing laser sources and detectors. It is probable that these limitations will be removed in the near future and it is recommended that exploratory experiments be continued. The differential absorption method for obtaining the spatial distribution of atmospheric gases is well developed for such gases as water vapor and oxygen where the basic laser frequency lies close to the center of the particular absorption line. Further investigation is recommended in the field of laser frequency shifting. Additional information is also required on the shape of the absorption line, particular in the region where the line reflects both pressure and Doppler broadening. Author

N72-25359*# West Indies Univ., Kingston (Jamaica). Dept. of Physics.
THE LASER RADAR ABOVE 30 KILOMETERS c16
B. R. Clemesha *In* NAS-NAC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 201-206 refs (See N72-25347 16-13)
(Grant AF-AFOSR-616-67)
Avail: NTIS HC $37.50 CSCL 20E

A short 'state of the art' report on laser radar observations of the atmosphere at heights greater than 30 km is presented. Graphs of recent measurements of the Rayleigh backscattering function between 30 and 70 and above 50 kilometers are included. Author

N72-25360*# Massachusetts Inst. of Tech., Cambridge.
LASER RADAR MEASUREMENTS OF THE AEROSOL CONTENT OF THE ATMOSPHERE
Gerald W. Grams (NASA. Electron. Res. Center, Cambridge, Mass.) *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 207-212 refs (See N72-25347 16-13)
(Grants NGR-22-009-114; NGR-22-009-131)
Avail: NTIS HC $37.50 CSCL 04A

A summary of the results of laser radar observations of atmospheric aerosols is presented along with a description of the laser radar system devised during the study and of the data handling techniques utilized for the analysis of the data of the temporal and spatial distribution of atmospheric aerosols. Current research conducted by the group is directed toward the analysis of the frequency spectrum of laser radar echoes to obtain absolute measurements of the dust content of the atmosphere by resolving the molecular and aerosol contributions to the laser radar echoes. Author

N72-25361*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
COMMENTS ON BISTATIC LIDAR c16
John A. Reagan *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 213-215 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20E

The use of bistatic lidar to determine the size and concentration of atmospheric aerosols is discussed. It is shown that bistatic measurements made at several scattering angles coupled with logical assumptions about the size distribution can provide estimates of the aerosol concentration, and by polarization measurements, meteorological parameters that influence the vertical distribution of particulates can be determined. F.O.S.

N72-25362*# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PROBING THE ATMOSPHERE WITH HIGH POWER, HIGH RESOLUTION RADARS
Kenneth R. Hardy and Isadore Katz (APL, Johns Hopkins Univ., Silver Spring, Md.) *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 217-243 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

Observations of radar echoes from the clear atmosphere are presented and the scattering mechanisms responsible for the two basic types of clear-air echoes are discussed. The commonly observed dot echo originates from a point in space and usually shows little variation in echo intensity over periods of about 0.1 second. The second type of clear-air radar echo appears diffuse in space, and signal intensities vary considerably over periods of less than 0.1 second. The echoes often occur in thin horizontal layers or as boundaries of convective activity; these are characterized by sharp gradients of refractive index. Some features of clear-air atmospheric structures as observed with radar are presented. These structures include thin stable inversions, convective thermals, Benard convection cells, breaking gravity waves, and high tropospheric layers which are sufficiently turbulent to affect aircraft. Author

N72-25363*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
FURTHER REMARKS ON ATMOSPHERIC PROBING BY ULTRASENSITIVE RADAR
David Atlas *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 245-252 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

This paper is supplementary to that of Hardy and Katz. It emphasizes the meteorological value of the various capabilities of ultrasensitive radar, highlights the points of agreement and disagreement, and focuses upon the directions of promising research. The theory of backscatter from a refractively turbulent region is said to be confirmed by the radar observations both with respect to magnitude and wavelength dependence. A reason for the apparent discrepancy between the results of some of the forwardscatter experiments and theory is suggested. Disagreement still exists with respect to the origin of clear air sea breeze echoes; the author does not agree with Hardy and Katz that they are due to insects. However, it is agreed that some unusually widespread echo displays on clear days are indeed due to insects. The meteorological value of ultrasensitive radars demonstrated by Hardy and Katz, here, and by others is so profound as to demand their use in remote atmospheric probing. Author

N72-25364*# Environmental Science Services Administration, Washington, D.C. Wave Propagation Lab.
ATMOSPHERIC PROBING BY DOPPLER RADAR
Roger M. Lhermitte *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 253-285 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

A survey is presented of the application of Doppler techniques to the study of atmospheric phenomena. Particular emphasis is placed on the requirement of adequate digital processing means for the Doppler signal and the Doppler data which are acquired at a very high rate. The need is discussed of a two or three Doppler method as an ultimate approach to the problem of observing the three-dimensional field of particle motion inside convective storms. Author

N72-25365*# National Severe Storms Lab., Norman, Okla.
COMMENTS ON DOPPLER RADAR APPLICATIONS c07
Edwin Kessler *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 287-289 (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 17I

The application of Doppler methods to theoretical or meteorological problems is discussed. Research for using radar to study and monitor severe thunderstorms, turbulence, and tornadoes is recommended. F.O.S.

N72-25366*# McGill Univ., Montreal (Quebec).
COMMENTS ON HIGH POWER HIGH RESOLUTION RADARS c07
J. S. Marshall *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 291-293 (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 17I

Comments concerning high resolution radar are presented. Discussions on angels and Doppler radar are included. F.O.S.

N72-25367*# Stanford Univ., Calif. Electronics Labs.
A REVIEW OF TRANSHORIZON PROPAGATION AS A POSSIBLE TOOL FOR REMOTE PROBING OF THE ATMOSPHERE c07
Donald C. Cox *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 295-336 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20N

It is concluded that the state or structure of the atmosphere cannot be inferred unambiguously from measurement techniques used in experiments. Extensions or combinations of available techniques appear promising for use in the remote probing of the atmosphere. Author

N72-25368*# Wisconsin Univ., Madison.
IDENTIFICATION OF ATMOSPHERIC STRUCTURE BY COHERENT MICROWAVE SOUNDING
William P. Birkemeier *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 337-358 refs (See N72-25347 16-13)
(Grants NSF GP-667; NSF GP-4352; NSF GA-1291)
Avail: NTIS $37.50 CSCL 04A

Two atmospheric probing experiments involving beyond-the-horizon propagation of microwave signals are reported. In the first experiment, Doppler-shift caused by the cross path wind is measured by a phase lock receiver with the common volume displaced in azimuth from the great circle. Variations in the measured Doppler shift values are explained in terms of variations in atmospheric structure. The second experiment makes use of the pseudorandom sounding signal used in a RAKE communication system. Both multipath delay and Doppler shift are provided by the receiver, permitting the cross section of the atmospheric layer structure to be deduced. Author

N72-25369*# Hughes Aircraft Co., Culver City, Calif.
THEORETICAL INTERPRETATIONS OF SCATTER PROPAGATION c07
Albert D. Wheelon *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 359-365 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20N

The general features of a theory for signal scattering by turbulent irregularities are reviewed. Electromagnetic and path geometrical characteristics of the propagation are shown mathematically. The basic signal statistical distribution of the received field is also considered. The relationship of signal amplitude and phase to one another at succeeding instants of time provides a useful measure of signal fine structure. J.A.M.

N72-25370*# State Univ. of New York, Stony Brook.
COMMENTS ON THE POSSIBILITY FOR DETERMINING DETAILED ATMOSPHERIC STRUCTURE FROM TRANS-HORIZON RADIO PROPAGATION MEASUREMENTS
Richard B. Kieburtz *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 367-368 (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

A deterministic approach is used to examine the atmospheric structure at any instant in time, with an assumption as to the degree of anisotropy. A statistical model is also used to relate the experimental data to atmospheric structure. With this model, the three dimensional spectrum of spatial wave numbers of the refractivity fluctuations are determined, along with correlations which exist within the spectrum. J.A.M.

N72-25371*# California Univ., Berkeley. Radio Astronomy Lab.
A SELECTIVE REVIEW OF GROUND BASED PASSIVE MICROWAVE RADIOMETRIC PROBING OF THE ATMOSPHERE
William J. Welch *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 369-396 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

The absorption of the various atmospheric constituents with significant microwave spectra is reviewed. Based on the available data, an estimate is made of the uncertainty in the microwave absorption coefficients of the major constituents, water vapor and oxygen. Then there is an examination of the integral equations which describe the three basic types of observations: measurement of the spectrum of absorption of the sun's radiation by an atmospheric constituent, measurement of the emission spectrum of a constituent, and measurement at one frequency of the zenith angle dependence of the absorption or emission of the atmosphere. Author

N72-25372*# Environmental Science Services Administration, Boulder, Colo. Research Labs.
GROUND-BASED MICROWAVE PROBING
Ed R. Westwater and Martin T. Decker *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 397-408 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

Theoretical and experimental activities in remote sensing were conducted. The projects are: (1) the linear statistical inversion method, (2) vertical temperature profile determination from microwave emission measurements near 60 GHz, (3) radio path length correction determination from emission measurements at 20.6 GHz, and (4) liquid water content determination of thunderstorm cells by emission measurements at 10.7 GHz. Author

N72-25373*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Res. Lab. of Electronics.
PASSIVE REMOTE SENSING AT MICROWAVE WAVELENGTH
David H. Staelin *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 409-434 refs (See N72-25347 16-13)
(Grant NGR-22-009-016)
Avail: NTIS HC $37.50 CSCL 04A

The ways in which radio signals are affected by meteorological parameters are described, as are methods for interpreting the signals, the state-of-the-art in instrumentation, the current state

of development of the field, and some problems and prospects for the future. It is shown that the temperature profile of the atmosphere, water vapor and ozone distribution, cloud water content, and certain surface properties can be measured with sufficient accuracy to provide useful meteorological information.
Author

N72-25374*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
THE USE OF HIGH FREQUENCY INFRARED RADIOMETRY FOR REMOTE ATMOSPHERIC PROBING WITH HIGH VERTICAL RESOLUTION
Lewis D. Kaplan *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 435-442 refs (See N72-25347 16-13)
(Contract NSF GA-1310X)
Avail: NTIS HC $37.50 CSCL 04A

The necessity of obtaining soundings of temperature and water vapor content of the lower troposphere with sufficient vertical resolution to determine the exchange of heat and moisture between the surface and the atmosphere is discussed. The means for solving the problem will be emission measurements in the high frequency end of the thermal infrared. The means for solving another problem is supplementary scanning with high area resolution.
Author

N72-25375*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETERMINATION OF THE TEMPERATURE PROFILE IN AN ATMOSPHERE FROM ITS OUTGOING RADIATION
Moustafa T. Chahine *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 443-451 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

A highly convergent relaxation method for the inversion of the full radiative transfer equation was developed. The results of the iterative solution indicate that convergence can be achieved over a wide range of initial guesses, enabling the temperature profile of a relatively unknown atmosphere to be unambiguously determined. The method is illustrated by examples for the outgoing radiance in the earth's atmosphere for the region of the 4.3 microns CO2 band, but can be similarly applied in other frequency ranges.
Author

N72-25376*# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TOWARDS AN OPTIMAL INVERSION METHOD FOR REMOTE ATMOSPHERIC SENSING
Jean I. F. King *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 453-464 refs (See N72-25347 16-13)
(Contract NAS5-3352)
Avail: NTIS HC $37.50 CSCL 04A

The inference of atmospheric structure from satellite radiometric observations requires an inversion algorithm. A variety of techniques was spawned to meet these demands. One class, the nonlinear inversion methods, copes with the problem of data noise. Unlike linear techniques which require a priori data smoothing, the nonlinear method can be applied directly to raw data. The algorithm discriminates the noise input by resolving the inferences into two types of solution, associating the real roots with atmospheric structure while ascribing the imaginary roots to noise.
Author

N72-25377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL APPROACHES TO REMOTE ATMOSPHERIC PROBING IN THE INFRARED FROM SATELLITES
William R. Bandeen *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 465-506 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

Thirteen different types of radiometric instruments either were flown in orbit or are scheduled to fly on forthcoming satellites. A fourteenth type, a very high resolution radiometer for geosynchronous altitude, is among several of the others whose development was stressed for the Global Atmospheric Research Program. Characteristics of each radiometric instrument and some applications of the different types of data are discussed.
Author

N72-25378*# Meteorological Service of Canada, Ottawa (Ontario).
SOME COMMENTS ON THE USE OF INFRARED RADIOMETRY FOR REMOTE ATMOSPHERIC PROBING
W. L. Godson *In* NAS-NRC Atmospheric Exploration by Remote Probes Jan. 1969 p 511-516 (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

A critique is presented of the lead paper by L.D. Kaplan on infrared radiometry. The following topics are analyzed: the extent to which the desirable thermal resolution of the lower troposphere can be achieved, the effects of complex cloud structure on infrared data, the effective weighting function if linearization is possible, remote sounding from below the atmosphere, first-guess fields and operational techniques to blend satellite infrared data into a mix of data from various meteorological systems, a simple inversion procedure for thermal structure, and problems arising from cloud and haze layers of variable amount and emissivity.
Author

N72-25379*# Barnes Engineering Co., Stamford, Conn.
REMOTE DETECTION OF CAT BY INFRARED RADIATION c20
Robert W. Astheimer *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 517-524 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04B

The remote detection of clear air turbulence (CAT) was investigated using an airborne scanning infrared spectrometer. Results of the flight tests indicated a high correlation between turbulence and temperature changes, and remote detection was obtained at distances up to 10 miles. Since CAT can extend horizontally over 50 miles, but is usually limited vertically to a few thousand feet, it is concluded that the best avoidance maneuver is a change in altitude.
F.O.S.

N72-25380*# IIT Research Inst., Chicago, Ill.
REMOTE SENSING OF WINDS AND ATMOSPHERIC TURBULENCE BY CROSS CORRELATION OF PASSIVE OPTICAL SIGNALS c20
A. J. Montgomery *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 525-553 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04B

A new method is described for the remote measurement of winds and atmospheric turbulence by the cross-correlation of passive optical signals. If small local variations in atmospheric density, temperature or other parameters cause fluctuations in scattered or thermal radiation detected by a radiometer on the ground, then the cross-correlation of fluctuations detected by two radiometers with crossed fields of view can yield turbulence information pertaining to the region about this intersection point. When the fields of view are not quite crossed turbulent eddies will be convected through the fields of view sequentially, and the transit times of the eddies identified by the correlation procedure will yield wind information. The successful application of this technique, detecting fluctuations in scattered sunlight, has demonstrated both the potential, and the present limitations of the method, which are discussed. Results for the power spectrum of the fluctuations and for winds at an altitude of 61 meters are shown.
Author

N72-25381*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NOISE ELIMINATION BY PIECEWISE CROSS CORRELATION OF PHOTOMETER OUTPUTS
Fritz R. Krause and Benjamin C. Hablutzel *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 555-587 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

A piecewise cross correlation technique has been developed to analyze the outputs of remote detection devices. The purpose of this technique is to eliminate the noise from optical background fluctuations, from transmission fluctuations and from detectors by calculating the instantaneous product of the detector output and a reference signal. Each noise component causes positive and negative oscillations of the instantaneous product and may thus be cancelled by an integration of the instantaneous product. The resultant product mean values will then contain the desired information on the spatial and temporal variation of emission, absorption and scattering processes in the atmosphere. Author

N72-25382*# Colorado State Univ., Fort Collins.
FIELD TESTS OF THE OPTICAL CROSS-BEAM SYSTEM **c14**
V. A. Sandborn *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 589-594 ref (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 14B

Recent detailed evaluation of the use of an optical cross-beam system to measure convective wind velocities are reported. Low level measurements, where the optical system is looking at either the earth surface or cloud banks, are demonstrated. Further information on the nature and scale of the light fluctuations is reviewed. Author

N72-25383*# Stanford Research Inst., Menlo Park, Calif.
SFERICS
E. T. Pierce *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 595-616 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

The properties of sferics (the electric and magnetic fields generated by electrified clouds and lightning flashes) are briefly surveyed; the source disturbance and the influence of propagation being examined. Methods of observing sferics and their meteorological implications are discussed. It is concluded that close observations of electrostatic and radiation fields are very informative, respectively, upon the charge distribution and spark processes in a cloud; that ground-level sferics stations can accurately locate the positions of individual lightning flashes and furnish valuable knowledge on the properties of the discharges; but that satellite measurements only provide general information on the level of thunder activity over large geographical regions. Author

N72-25384*# Environmental Science Services Administration, Boulder, Colo. Research Labs.
ACOUSTIC METHODS OF REMOTE PROBING OF THE LOWER ATMOSPHERE
C. G. Little *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 619-631 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

The potential usefulness of acoustic methods for the remote probing of the lower atmosphere is reviewed. Starting with a comparison of the effects of temperature, wind, and humidity fluctuations upon the refractive index of air to electromagnetic and acoustic waves, it is shown that the fluctuations in acoustic refractive index may be expected to be about one thousand times stronger than in the radio case. Since the scattered power is proportional to the square of the refractive index fluctuations, the scatter of acoustic waves may be expected to be roughly one million times stronger than for radio waves. In addition, the million-fold ratio between the velocities of electromagnetic and acoustic waves results in an acoustic system requiring one million times less bandwidth to interrogate a given atmospheric volume. Author

N72-25385*# Environmental Science Services Administration, Rockville, Md. Research Labs.
ATMOSPHERIC SOUND PROPAGATION
Richard K. Cook *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 633-669 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04A

The propagation of sound waves at infrasonic frequencies (oscillation periods 1.0 - 1000 seconds) in the atmosphere is being studied by a network of seven stations separated geographically by distances of the order of thousands of kilometers. The stations measure the following characteristics of infrasonic waves: (1) the amplitude and waveform of the incident sound pressure, (2) the direction of propagation of the wave, (3) the horizontal phase velocity, and (4) the distribution of sound wave energy at various frequencies of oscillation. Some infrasonic sources which were identified and studied include the aurora borealis, tornadoes, volcanos, gravity waves on the oceans, earthquakes, and atmospheric instability waves caused by winds at the tropopause. Waves of unknown origin seem to radiate from several geographical locations, including one in the Argentine. Author

N72-25386*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
VERTICAL PROFILES OF WIND AND TEMPERATURE BY REMOTE ACOUSTICAL SOUNDING **c20**
Herbert L. Fox *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 671-679 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04B

An acoustical method was investigated for obtaining meteorological soundings based on the refraction due to the vertical variation of wind and temperature. The method has the potential of yielding horizontally averaged measurements of the vertical variation of wind and temperature up to heights of a few kilometers; the averaging takes place over a radius of 10 to 15 km. An outline of the basic concepts and some of the results obtained with the method are presented. D.L.G.

N72-25387*# Lamont Geological Observatory, Palisades, N.Y.
PROBING THE ATMOSPHERE WITH INFRASOUND
Eric S. Posmentier and William L. Donn *In* NAS-NRC Atmospheric Exploration by Remote Probes, vol. 2 Jan. 1969 p 681-691 refs (See N72-25347 16-13)
(Rept-1245) Avail: NTIS HC $37.50 CSCL 04A

Recent studies are reported which have contributed to the knowledge of atmospheric structure and have established the practicality of infrasonic techniques for probing the atmosphere to heights of 120 km or more. Observations of a few types of infrasound are reviewed, and the theories used to account for the infrasound propagation and the deduced atmospheric structures are discussed. D.L.G.

N72-25388*# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
THE HUDSON LABORATORIES MICROBAROGRAPH SYSTEM: RESULTS AND FUTURE TRENDS **c14**
I. Tolstoy and T. Herron *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 693-696 refs (See N72-25347 16-13)
(Contract Nonr-266(84))
(Rept-327) Avail: NTIS HC $37.50 CSCL 14B

The ultralow frequency microbarograph system is described, and some results for periods ranging from a few minutes to a few hours are presented. Problems encountered during operation of the system are also discussed. Author

N72-25389# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPONENTIAL MODEL OF THE IONOSPHERIC D REGION
G. Nestorov [1972] 12 p refs Transl. into ENGLISH from Kosmich. Issled. Akad. Nauk SSSR (Moscow), v. 12, no. 1, 1972 p 43-53
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The approximation of the N(h) profile by two exponential functions is proposed. The first function reflects the influence of cosmic rays and does not undergo substantial changes during a day. The second takes account of solar X-rays and Lyman alpha radiation and depends on the zenith angle of the sun. The approximation permits the correlation of absorption data with the physical parameters of the D region. This model also allows calculation of the change in the N(h) profile during solar chromospheric flares. Author

N72-25390# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 71/4-6, APRIL-JUNE 1971
L. Liszka, ed. 1971 109 p Prepared jointly with European Space Sounding Rocket Range
Avail: NTIS HC $7.50

Data recorded at Kiruna relating to geomagnetic variations and storms, earth currents, auroras, cosmic noise, and ionospheric absorption, are presented. Measurements include geomagnetic K-indices, all-sky camera records, and vertical incidence ionospheric soundings. Magnetograms, riometer recordings, and routine ionograms from the down range station are reproduced. ESRO

N72-25391# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 71/7-9, JULY - SEPTEMBER 1971
L. Liszka, ed. 1971 93 p Prepared jointly with European Space Sounding Rocket Range
Avail: NTIS HC $6.75

Data recorded at Kiruna relating to geomagnetic variations and storms, earth currents, auroras, cosmic noise, and ionospheric absorption are presented. Measurements include geomagnetic K-indices, all-sky camera records, and vertical incidence ionospheric soundings. Magnetograms, riometer recordings, and routine ionograms from the down range station are reproduced. ESRO

N72-25392# Kiruna Geophysical Observatory (Sweden).
ON THE ORIGIN OF THE INFRASOUND BACKGROUND AT 1.9 Hz
Ludwik Liszka and Hans Westin Mar. 1972 14 p refs
(KGO-724) Avail: NTIS HC $3.00

The infrasonic background at 1.9 Hz observed in northern Scandinavia is compared with jet streams in the atmosphere. Evidence that the 1.9 Hz background is related to variations of jet streams is presented. The observed amplitudes of the 1.9 Hz background are, in 20% of the cases observed, higher than those derived from known spatial spectra of velocity variations in the atmosphere. Author (ESRO)

N72-25393# Kiruna Geophysical Observatory (Sweden).
DETECTION OF 2 Hz INFRASOUND FROM UNDERGROUND NUCLEAR EXPLOSIONS
Ludwik Liszka Mar. 1972 21 p refs Sponsored in part by the Res. Inst. of Natl. Defence
(KGO-722) Avail: NTIS HC $3.25

The equipment for narrowband detection of infrasound at 1.9 Hz at Kiruna, Sweden was used for recording infrasound generated by underground nuclear explosions. During favorable meteorological conditions, infrasound from explosions at distances up to 4000 km was detected. Supersonic signals, travelling at average group velocities larger than the velocity of sound, were detected in addition to ordinary signals. A possible explanation of supersonic signals is proposed. Author (ESRO)

N72-25394# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA: DATA SUMMARY 71/10-12, OCTOBER-DECEMBER 1971
L. Liszka, ed. 1971 130 p Prepared jointly with European Space Sounding Rocket Range
Avail: NTIS HC $8.50

Data recorded at Kiruna relating to geomagnetic variations and storms, earth currents, auroras, cosmic noise, and ionospheric absorption are presented. Measurements include geomagnetic K-indices, all-sky camera records, and vertical incidence ionospheric soundings. Magnetograms, riometer recordings, and routine ionograms from the down range station are reproduced. Author (ESRO)

N72-25395# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
POTENTIAL DOUBLE LAYERS IN THE IONOSPHERE
Lars B. Block Apr. 1972 52 p refs Supersedes TRITA-EPP-71-14 Submitted for publication
(TRITA-EPP-72-07; TRITA-EPP-71-14) Avail: NTIS HC $4.75

The acceleration of auroral particles in ionospheric double layers is considered. The theory of double layers, including the instability leading to double layers, is presented. It is shown that both stable and unstable double layers should occur in the topside ionosphere above 1000 km altitude and also in the F region for observed field-aligned current densities. The stability of double layers depends on the current direction in certain cases. When double layers are formed, plasma is accelerated upwards from the topside ionosphere. This effect may aid in the explanation of the ionospheric trough. Author (ESRO)

N72-25396# European Space Research Inst., Frascati (Italy).
ON THE SEASONAL VARIATION OF UPPER ATMOSPHERIC SODIUM
G. Fiocco and G. Visconti (Aquila Univ.) [1971] 14 p refs
Avail: NTIS HC $3.00

The energetic budget for dust particles in the upper atmosphere is considered. Their temperature and the related sodium evaporation rate are estimated to explain the origin and seasonal variations of free sodium atoms. The origin of these atoms was attributed to sublimation from dust. In daytime, the particle temperature can be substantially higher than the ambient gas temperature, the density and temperature fluctuation of the ambient gas control, the seasonal variation of the particle temperature, and the related Na abundance. Author (ESRO)

N72-25397# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
GEOPHYSICS AND SPACE DATA BULLETIN. VOLUME 8, NO. 3: THIRD QUARTER 1971
Anne L. Carrigan Dec. 1971 256 p refs
(AF Proj. 8666)
(AD-738327; AFCRL-71-0576; AFCRL-SR-126) Avail: NTIS CSCL 03/2

Contents: Total field intensity magnetometer; Cosmic ray neutron intensity monitor; Extremely low frequency noise; Riometer; Solar optical patrol observations; Solar radio emission; Ionospheric measurements. GRA

N72-25398# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
NOISE IN THE NEUTRAL SHEET IN THE GEOMAGNETIC TAIL Final Scientific Report, 1 Dec. 1970 - 30 Nov. 1971
James W. Dungey Jan. 1972 18 p refs
(Contract F61052-70-C-0009; AF Proj. 7601)
(AD-738316; AFCRL-72-0116) Avail: NTIS CSCL 04/1

An instability which could cause noise in the neutral sheet is proposed. The starting point is the self-consistent model of the undisturbed sheet developed in the absence of a normal component of magnetic field by Cowley. In this steady state the electrons trapped in the field reversal region move across the tail from dusk to dawn, undergoing acceleration in the cross tail

electric field at the dusk end. After emerging from the acceleration region only ions in this region are relatively cold. The authors found that a wave propagating at an angle to the normal of the current sheet can be unstable due to a double jump in the velocity distribution. Resonating electrons give energy to the wave, while the wave energy probably leads to heating of the cold ion background. Author (GRA)

N72-25399# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
OBSERVATION OF A GRAVIMETER WITH TWO ELASTIC SYSTEMS SET UP ON A MOBILE BASE
V. A. Romanyuk Jan. 1972 99 p refs Transl. into ENGLISH from the publ. "Apparatura i Metody Izmereniya Sily Tyazhesti na More" Moscow Nauka, 1970 p 3-35
(AD-737110; ACIC-TC-1777) Avail: NTIS CSCL 08/5

The influence of tilts and accelerations affecting a gravimeter with two elastic systems set up on a mobile base has been theoretically investigated. An appropriate differential motion equation and a correction formula for the influence of tilts and accelerations have been obtained. Peculiarities of the influence of tilts and accelerations with the gravimeter set in a Cardan suspension or on a gyrostabilized platform have been investigated. Author (GRA)

N72-25400# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
ESTIMATE OF THE ACCURACY OF GRAVITY MEASUREMENTS MADE BY L. V. SOROKIN ON THE BLACK SEA IN 1930-1935
P. A. Stroev and G. S. Markov Jan. 1972 13 p refs Transl. into ENGLISH from the monograph "Apparatura i Metody Izmereniya Sily Tyazhesti na More" Moscow, 1970 p 58-62
(AD-737108; ACIC-TC-1781) Avail: NTIS CSCL 08/5

A comparison was made of the gravimetric observations on the Black Sea which were carried out by L. V. Sorokin (1930-1935) and the Institute of Geophysics of the USSR Academy of Sciences (1960). As a result of this comparison it was noted that Sorokin's measurements do not have noticeable systematic errors and are characterized by a random error of plus or minus 10 - 12 mgals. The performed analysis has confirmed the reliability of the general character of the gravity field in the water area of the Black Sea obtained by L. V. Sorokin.
Author (GRA)

N72-25401# North American Weather Consultants, Goleta, Calif.
PERFORMANCE OF AN ATMOSPHERIC WATER RESOURCES RESEARCH PROGRAM IN THE HUNGRY HORSE AREA, MONTANA, 1970-1971 SEASON Final Report
15 Dec. 1971 115 p
(Contract DI-14-06-D-6039)
(PB-206948; IR-5) Avail: NTIS HC $3.00 CSCL 04B

The Hungry Horse cloud seeding project in western Montana has completed 5 seasons of operation. The primary goal was to determine the feasibility of increasing water supplies through seeding methods, with a secondary goal of increasing runoff into the Hungry Horse reservoir. The investigations and results of 5 years of operation are summarized. During the past 5 years principal reliance for seeding has been placed upon a network of upwind valley generators because of the inaccessibility of high level sites. Evaluation of results to date has provided special insights which can improve the methodology of evaluation.
Author (GRA)

N72-25402# University of Southern Calif., Los Angeles. Dept. of Geological Sciences.
ABSTRACT VOLUME, NATIONAL COASTAL AND SHALLOW WATER RESEARCH CONFERENCE (SECOND)
Donn S. Gorsline, ed. Oct. 1971 460 p refs Conf. held at Baton Rouge, La., 1-2 Oct. 1971, Newark, Del., 9-10 Oct. 1971, and Los Angeles, 30-31 Oct. 1971 Sponsored by ONR
(AD-735486) Avail: NTIS CSCL 08/10

The report contains abstracts of papers given at the conference concerning research along the coastal zone and shallow water margins of the continent. Author (GRA)

N72-25403# University Coll., London (England). Dept. of Physics.
GLOBAL TEMPERATURE AND DENSITY STRUCTURE IN THE LOWER THERMOSPHERE
David Rees Aug. 1971 28 p refs
(Contract F61052-68-C-0057; AF Proj. 8605)
(AD-738330; AFCRL-71-0566; SR-4) Avail: NTIS CSCL 04/1

Neutral temperature and molecular diffusion coefficient measurements at mid-latitude and in the auroral zone are used to derive global models of temperature, air density and pressure in the lower thermosphere. The models, applicable to geomagnetically quiet periods, below 200 km and for the period 1967-1970 of relatively high solar activity, differ substantially from earlier models derived from satellite drag data. The small sample of temperature measurements available for the analysis (about 50 in total) has naturally resulted in an inferior description of the total sources of variability of upper atmosphere structure compared with the analyses and computations of Jacchia 1965 and 1970 for example. The data have therefore been used to demonstrate three clear observations which have not appeared in previous analyses. Author (GRA)

N72-25404# Southern Methodist Univ., Dallas, Tex. Dept. of Geological Sciences.
STUDIES TO IMPROVE THE ESTIMATION OF SEISMOLOGICAL HYPOCENTERS AND MAGNITUDES Final Report
Eugene Herrin and William T. Tucker 6 Jan. 1972 156 p refs
(Grant AF-AFOSR-414-67; ARPA Order 292-78; AF Proj. 8652)
(AD-737405; SMU-80-34; AFOSR-72-0426TR) Avail: NTIS CSCL 08/11

The report gives the development of a useful, mathematical model for the teleseismic travel-times and discusses the statistical techniques involved in the estimation of model parameters. The problems which limit the accuracy of epicenter determinations are discussed in detail. Author (GRA)

N72-25405# Texas A&M Univ., College Station. Remote Sensing Center.
PLANNING AND IMPLEMENTATION OF REMOTE SENSING EXPERIMENTS Final Report, Sep. 1970 - Sep. 1971
George L. Huebner, Jr. Nov. 1971 133 p refs
(Contract N62306-71-C-0029; A/M Proj. 756)
(AD-737348; RSC-756-1) Avail: NTIS CSCL 08/10

Contents: TEKTITE II experiment-upwelling detection (NASA Mx 138); Design of oceanographic experiments (Gulf of Mexico, Mx 159); Design of oceanographic experiments (Gulf of Mexico, Mx 165); Experiments on thermal pollution; Remote sensing newsletter; Symposium on remote sensing in marine biology and fishery resources. GRA

N72-25406# Marine Minerals Technology Center, Tiburon, Calif.
GEOLOGIC PREDICTION DEVELOPING TOOLS AND TECHNIQUES FOR THE GEOPHYSICAL IDENTIFICATION AND CLASSIFICATION OF SEA FLOOR SEDIMENTS Annual Report, 19 Jan. - 19 Oct. 1971
Burton B. Barnes, Robert F. Corwin, John H. Beyer, Jr., and T. G. Hildenbrand Feb. 1972 292 p refs
(ARPA Order 1579)
(AD-737282; MMTC-2; ERL-224) Avail: NTIS CSCL 08/7

The experiments described in this report were developed to test and evaluate prototype tools and advanced techniques to predict geologic conditions on the sea floor. Emphasis has been placed on determining the mass physical properties of sea-floor sediments and rocks using geophysical tools for the identification of associated parameters. A direct current resistivity system, was successfully developed. It is feasible to use electromagnetic

sounding to measure conductivity and thereby deduce porosity at shallow depths below the sea floor-water interface. A seismic shear wave generator prototype tool was built and successfully tested to produce the transverse wave form in saturated marine sediments. Author (GRA)

N72-25407# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SELECTED GEOLOGIC LITERATURE, LOWER MISSISSIPPI VALLEY DIVISION AREA: INDEX AND ANNOTATED BIBLIOGRAPHY, SUPPLEMENT 5
R. T. Saucier Dec. 1971 145 p refs
(AD-735775; AEWES-TR-3-712-Suppl-5) Avail: NTIS CSCL 08/7

Approximately 70 references to published and unpublished items of geologic literature have been evaluated and annotated since the publication of Supplement 4 in July 1970. The new references have been combined with those in the previous supplements using a magnetic-tape-based system and are presented in this report, which supersedes the previous supplements. Author (GRA)

N72-25408# Wisconsin Univ., Milwaukee. Dept. of Geological Sciences.
DEVELOPMENT OF CAPABILITIES OF OPTICAL DIFFRACTION ANALYSIS FOR QUANTITATIVELY COMPARING AND CORRELATING ROCK FABRICS AND FABRIC CHANGES Annual Technical Report, 11 Jan. 1971 - 10 Jan. 1972
Howard J. Pincus Feb. 1972 86 p refs
(Contract DI-BM-HO210003; ARPA Order 1579)
(AD-737390; AR-1) Avail: NTIS CSCL 08/7

Photographs and acetate peels of rock specimens undergoing deformation have been converted to their two-dimensional Fourier amplitude transforms by optical diffraction. Changes in the transforms reflect spatial changes in the rock fabrics. Maps of the transforms assist in their interpretation. Transforms have also been produced using partially coherent light and a modified microscope system. Suites of spatial filters produced from theoretical considerations and modified transforms have been constructed for differential analysis of the spatial frequency content of input photographs. Holographic subtraction of one test input from another has been started, laying the foundation for another approach to mapping fabric changes in progressive deformation. Author (GRA)

N72-25761*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOPOTENTIAL AT SYNCHRONOUS-ORBIT ALTITUDES
C. A. Wagner *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 26-29 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 08N

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-25409* National Aeronautics and Space Administration, Washington, D.C.
TWO COLOR HORIZON SENSOR Patent
Harold H. Seward, Mark Gorstein, and Ian G. McWilliams, inventors (to NASA) Issued 18 Apr. 1972 6 p Filed 21 May 1970 Supersedes N70-35861 (08 - 19, p 3591
(NASA-Case-ERC-10174; US-Patent-3,657,549;
US-Patent-Appl-SN-39344; US-Patent-Class-250-209;
US-Patent-Class-250-83.3UV; US-Patent-Class-250-226;
US-Patent-Class-350-203) Avail: US Patent Office CSCL 14B

A radiant energy sensor which may be employed to detect discrete radiant energy wavelength bands from a selected portion of a radiating body such as the horizon is described. As radiant energy from various portions of the body is detected, the energy is analyzed according to its color characteristics by means of a double monochrometer. A combination lens-prism system is used to refract the radiant energy according to its wavelength. Photo detectors in the double monochrometer respond to two selected wavelength bands of the radiant energy and are connected to a difference amplifier to determine the null output of the two detectors. The null condition is adjusted to correspond with the discrete wavelength bands to be sensed.
Official Gazette of the U.S. Patent Office

N72-25410* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANGULAR VELOCITY AND ACCELERATION MEASURING APPARATUS Patent
Louis Melamed, inventor (to NASA) Issued 25 Apr. 1972 4 p Filed 11 Jun. 1970 Supersedes N70-36079 (08 - 19, p 3543)
(NASA-Case-ERC-10292; US-Patent-3,657,928;
US-Patent-Appl-SN-45519; US-Patent-Class-73-515;
US-Patent-Class-73-521; US-Patent-Class-350-160R) Avail: US Patent Office CSCL 14B

A combined angular velocimeter and accelerometer is described. The device is formed by a film of cholesteric phase liquid crystalline material retained between rotary and stationary discs. Shear stresses exerted on the liquid crystalline film by movement of the rotary disc, cause changes in the initial coloration of the film. Bands of different colors or colorless areas are produced and can be observed through the stationary disc. The radii of the rings are proportional to the rotation rate and the radial velocity of the band of rings is proportional to the angular acceleration. P.N.F.

N72-25411* North American Rockwell Corp., Downey, Calif.
IMPACT MONITORING APPARATUS Patent
Leland O. Mortensen, inventor (to NASA) Issued 18 Apr. 1972 4 p Filed 2 Dec. 1970 Supersedes N72-15418 (10 - 06, p 771)
(NASA-Case-MSC-15626-1; US-Patent-3,656,352;
US-Patent-Appl-SN-94374; US-Patent-Class-73-492;
US-Patent-Class-73-12; US-Patent-Class-116-114AH) Avail: US Patent Office CSCL 14B

An impact monitoring apparatus for indicating and recording the magnitude of force imposed in a specific direction on a particular axis is described. The device consists of two parallel saw-tooth leaf springs mounted in cantilever fashion, one above the other. The upper leaf spring supports at its free end a designated mass. When a force is applied along the axis, the free ends of the spring are deflected so that the saw-tooth portions mechanically engage and lock into one another. The extent of the engagement is proportional to the force applied.
P.N.F.

N72-25412* Boeing Co., Huntsville, Ala.
HYDROGEN FIRE BLINK DETECTOR Patent
James M. Donnini, inventor (to NASA) Issued 25 Apr. 1972 4 p Filed 1 Jul. 1970 Supersedes N70-35520 (08 - 19, p 3540) Sponsored by NASA
(NASA-Case-MFS-15063; US-Patent-3,659,043;
US-Patent-Appl-SN-51477; US-Patent-Class-178-6.8;
US-Patent-Class-178-DIG.8; US-Patent-Class-340-227R) Avail: US Patent Office CSCL 14B

A hydrogen fire is described for use either on a high altitude rocket or in a ground installation. The device incorporates a conventional vidicon camera and television receiver-monitor. The device also comprises an infrared image converter to change the infrared radiation from the fire to visible light, thus making it

possible to view the hydrogen fire on the receiver-monitor. A red and blue filter wheel is placed ahead of the infrared image converter to produce a blinking image of the infrared light emitting source. Official Gazette of the U.S. Patent Office

N72-25413* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BACTERIAL CONTAMINATION MONITOR Patent
Edward Rich and Norman H. MacLeod, inventors (to NASA) Issued 30 May 1972 5 p Filed 31 Dec. 1969 Supersedes N70-22274 (08-09, p 1636)
(NASA-Case-GSC-10879-1; US-Patent-3,666,631; US-Patent-Appl-SN-889420; US-Patent-Class-195-127) Avail: US Patent Office CSCL 14B

A portable testing instrument is described for determining the level of bacterial and other microbial contamination within a monitored sample without the need for external electric recording devices or external power source. Utilized is an adenosine tri-phosphate (ATP) light reaction, the intensity of which is directly proportional to the presence of the ATP. High speed film is used for time displaying the low level of biochemical light produced, the light exposure intensity being compared to a calibrated scale for determination of the bacterial contamination level. Official Gazette of the U.S. Patent Office

N72-25414* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LIGHT SENSOR Patent
Louis F. Schmidt, inventor (to NASA) Issued 16 May 1972 4 p Filed 22 Jul. 1970 Supersedes N72-15422 (10 - 06, p 771) Sponsored by NASA
(NASA-Case-NPO-11311; US-Patent-3,663,753; US-Patent-Appl-SN-57252; US-Patent-Class-178-7.92; US-Patent-Class-350-175FS) Avail: US Patent Office CSCL 20F

The development of an objective lens system for use in a light-sensing device is discussed. The lens system produces a backwardly curving image plane of a starfield which matches the similarly curved surface of the photocathode of an image dissector tube. The sensor functions to identify each star that enters the field of view during a roll search and provides a signal proportional to the roll error angle to an attitude control circuit. With this system, the sun or any celestial light source may be used to provide spacecraft orientation and guidance. P.N.F.

N72-25415 Ohio State Univ., Columbus.
***AN INVESTIGATION INTO SOME PROBLEMS ASSOCIATED WITH LUNAR ORBITER PHOTOGRAPHY* Ph.D. Thesis**
Peter James Morgan 1971 180 p
Avail: Univ. Microfilms Order No. 71-27326

This photographic system was operated from a high-velocity platform using relatively long exposure intervals. Consequently, a number of data reduction problems arise, which are further compounded by incomplete calibration data. The effects of a focal plane shutter and of image motion compensation are studied, and an investigation made into the possibility of recovering the unknown interior orientation parameters by dynamic calibration techniques. To overcome the problems involved, a new mathematical model, the augmented collinearity condition equations, is advanced. In these equations, the basic central projective relationships remain unaltered. This is accomplished by the introduction of translational and rotational velocities coupled with an exposure interval, delta t, defined with respect to some epoch for which values of the principal point are known. The introduction of these concepts fully explains the image geometry of a camera equipped with a focal plane shutter, as well as providing a point-by-point description of image velocity.
Dissert. Abstr.

N72-25416 British Broadcasting Corp., Kingswood (England). Research Dept.
UHF OFFSET GENERATOR FOR LABORATORY INTERFERENCE TESTS
D. E. Susans May 1972 6 p ref
(BBC-1972/15) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The equipment described in this report is designed to frequency shift a UHF signal, modulated or unmodulated, by up to 50 kHz. The resulting signal can simulate a second transmission in the same frequency channel in laboratory studies of interference. Author

N72-25417 California Inst. of Tech., Pasadena.
CHARACTERISTICS OF DISK AND HALO POPULATIONS DERIVED FROM PHOTOGRAPHIC PHOTOMETRY Ph.D. Thesis
Donna Etta Weistrop 1971 180 p
Avail: Univ. Microfilms Order No. 71-27113

Magnitudes were determined from iris photometer measurements of plates taken with the 48-inch Schmidt telescope. Calibration was provided by a photoelectric sequence in the field. Several models for the luminosity function and density distribution of population 2 field stars were assumed. Assuming also that all stars bluer than (B-V) sub O = .5 and fainter than V = 17 are members of Population 2, an upper limit of .00007 solar masses per cu pc was calculated for the local Population 2 density, a result significantly lower than local densities computed from the number of nearby stars suspected of halo membership. Some of the discrepancy may be due to the method used. Having estimated the contributions to the star counts due to Population 2 stars and disk giants and subgiants, the remaining stars were assumed to constitute a pure disk dwarf population. Density distributions for stars in successive (B-V) sub O intervals were calculated and combined to form a composite disk density distribution. Dissert. Abstr.

N72-25418*# Rocketdyne, Canoga Park, Calif.
HIGH-PRESSURE OXYGEN IMPACT TESTER Final Report
F. D. Raniere, G. A. Hood, and H. E. Marker 12 Apr. 1972 33 p refs
(Contract NAS8-27480)
(NASA-CR-123643; R-8962) Avail: NTIS HC $3.75 CSCL 14B

To extend the compatibility evaluation of candidate materials in oxygen, a high-pressure oxygen impact tester has been designed, developed, and installed at NASA/MSFC, Huntsville, Alabama. The tester has an operating range from ambient to 69,000 newton/sq m (10,000 psig) pressures and from the normal boiling point of liquid oxygen to 394 K (121 C) temperatures. The tester was designed to deliver 97.63 joules (72 ft-lb) of impact energy; however, variable height and weight can be achieved for threshold analysis. The system is completely remote and highly automated to furnish safe, reliable operation. High-frequency, fast-response instrumentation capabilities are provided to ensure maximum information output with the hope of minimizing the number of tests required for material acceptance. Author

N72-25419# Advisory Group for Aerospace Research and Development, Paris (France).
GUIDANCE AND CONTROL DISPLAYS Technical Evaluation Report
H. B. Lyon, Jr. Mar. 1972 9 p refs Presented at 13th Symp. of AGARD Guidance and Control Panel
(AGARD-AR-43) Avail: NTIS HC $3.00

The principal disciplines involved in the designing of displays for guidance and control and the evolution of the design process were discussed. An evaluation is presented from three viewpoints in an attempt to provide a better understanding of the total conference. These are: (1) general criteria (2) criteria for specific applications, and (3) new technology. Author

N72-25420# Advisory Group for Aerospace Research and Development, Paris (France).
FLIGHT TEST INSTRUMENTATION SERIES. VOLUME 3:

THE MEASUREMENT OF FUEL FLOW
J. T. France Mar. 1972 32 p refs
(AGARDograph-160-Vol-3; AGARD-AG-160-Vol-3) Avail: NTIS HC $3.75

The main methods of fuel flow measurement are discussed and the prospective user is advised of the factors that should be considered in deciding which type of meter to use and what precautions to take in the installation. Details are given of the three main types of flowmeters in common use, namely: turbine, orifice and angular momentum true mass. The theory of operation of each type of flowmeter is given together with details of accuracy, pressure drop, susceptibility to inlet and outlet conditions, form of output, and other key parameters likely to influence the choice of type of meter to be used. A quick reference summary is provided for the comparison of the performance of the three types of meter and various methods of calibrating flowmeters are discussed. A separate section is devoted to specialist flowmeters which are not in general use, but may have an application in flight test work. Particular emphasis is placed on solid state flowmeters which, due to the need to obtain improved life and reliability, are the subject of much research work. Author

N72-25421*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT TECHNOLOGY
1972 37 p Prepared in cooperation with Small Business Admin.
(NASA-SP-5926(02)) Avail: NTIS HC $1.00 CSCL 14B

New and improved materials, equipment, and techniques in measurement technology, developed by the aerospace industry, are presented for economic development in other industries. The developments are grouped as follows: (1) surface measurement, (2) alignment and orientation of bodies, (3) fluid measurement, (4) linear and angular measurements, and (5) force measurements. F.O.S.

N72-25422*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LARGE SPACE TELESCOPE (LST) PRELIMINARY ANALYSIS AND DESIGN REPORT, REVISION A
Dec. 1971 546 p refs Revised
(NASA-TM-X-68824) Avail: NTIS HC $29.50 CSCL 17H

The design of a three meter class large space telescope (LST) is described. Mechanical design concepts were developed which integrate the separate spacecraft, telescope and instrument structures in such a way as to minimize their interaction during launch and orbital operation. The LST is of the Ritchey-Chretin type with a primary optics focal ratio of 3.12 to an overall focal ratio of 12. F.O.S.

N72-25423*# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
SPACEBORNE CLOCK SYSTEM: SOME ALTERNATIVES FOR A PROPOSED NASA EXPERIMENT Final Report
Roger E. Beehler Nov. 1971 95 p refs
(NASA Order S-4749A-G)
(NASA-CR-122394; NBS-10735) Avail: NTIS HC $6.75 CSCL 14B

A spaceborne clock experiment is proposed with the objectives of improving international time and frequency comparisons, studying precise one-way Doppler tracking and one-way ranging techniques, performing relativistic studies, and developing new atomic frequency standards technology. Various alternatives are considered for accomplishing these goals, including the use of existing satellite and earth-based time dissemination systems as well as the development of a new frequency standard for this specific application. One conclusion is that several attractive alternatives already exist for meeting the goal of improved time and frequency dissemination. However, to achieve all the other 4 goals at the NASA-stated levels of accuracy, a spaceborne atomic frequency standard may be required. An analysis of achievements to date with quartz oscillators, rubidium standards, cesium beam standards, hydrogen masers, and several other possibilities leads to the conclusion that cesium and rubidium standards offer the best choices for the experiment as proposed by NASA. The greatest obstacle to a spaceborne atomic standard appears to be its electrical power requirements. Author

N72-25424*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
SPACE APPLICATIONS INSTRUMENTATION SYSTEMS
R. A. Minzner and J. D. Oberholtzer Washington May 1972 282 p
(NASA-TM-X-2066; C-136) Avail: NTIS HC $3.00 CSCL 22B

A compendium of resumes of 158 instrument systems or experiments, of particular interest to space applications, is presented. Each resume exists in a standardized format, permitting entries for 26 administrative items and 39 scientific or engineering items. The resumes are organized into forty groups determined by the forty spacecraft with which the instruments are associated. The resumes are followed by six different cross indexes, each organized alphabetically according to one of the following catagories: instrument name, acronym, name of principal investigator, name of organization employing the principal investigator, assigned experiment number, and spacecraft name. The resumes are associated with a computerized instrument resume search and retrieval system. Author

N72-25425*# Translation Consultants, Ltd., Arlington, Va.
AN INSTRUMENT FOR RECORDING SOIL TEMPERATURE GRADIENT
B. Kozak Washington NASA May 1972 6 p Transl. into ENGLISH from Orszagos Meteorologai Intez. (Budapest), v. 28, pt. 2, 1965 p 180-183
(Contract NASw-2038)
(NASA-TT-F-14262) Avail: NTIS HC $3.00 CSCL 14B

A gradient recorder for studying soil heat balance is discussed. The instrument operates on the same principle as the air temperature gradient recorder, and takes into consideration all the special requirements for soil and soil surface temperature measurements. Platinum resistance thermometers are used as sensors. Author

N72-25426# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A SUMMARY ON ALTITUDE DISPLAYS WITH AN ANNOTATED BIBLIOGRAPHY *Final Report, Nov. 1971 - Feb. 1972*
Jack J. Shrager May 1972 81 p refs
(FAA Proj. 076-311-01X)
(FAA-RD-72-46; FAA-NA-72-6) Avail: NTIS HC $6.75

A review of all literature published since 1960 relating to aircraft height or altitude display was made. This review was supplemented by a series of conferences with experimentalists currently working in this field. The results of the literature review and series of conferences are evaluated and summarized, and this is further supplemented by an annotated bibliography of the documents included in the literature review. Author

N72-25427*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
A COMPTON SCATTER ATTENUATION GAMMA RAY SPECTROMETER Patent Application
William E. Austin, inventor (to NASA) Filed 3 Mar. 1972 33 p Sponsored by NASA
(NASA-Case-MFS-21441-1; US-Patent-Appl-SN-231662) Avail: NTIS HC $3.75 CSCL 14B

A gamma ray spectrometer for use in intense radiation fields such as those in the vicinity of a rocket engine exhaust is described. A collimated radiation beam is Compton scattered toward shielded spectrometers to reduce the energy and intensity of the radiation and is energy selective among the spectrometers. The scattering targets are changeable to control the percentage

of the radiation scattered. Sum-Compton coincidence techniques are employed for data selection. NASA

N72-25428*# National Aeronautics and Space Administration, Washington, D.C.
ULTRAVIOLET ATOMIC EMISSION DETECTOR Patent Application
Walter Braun, Norman C. Peterson, Arnold M. Bass, and Michael J. Kurylo, III, inventors (to NASA) Filed 20 Mar. 1972 18 p (NASA-Case-HQN-10756-1; US-Patent-Appl-SN-236052) Avail: NTIS HC $3.00 CSCL 14B

A device and method are provided for performing qualitative and quantitative elemental analysis through the utilization of a vacuum UV chromatographic detector. The method involves the use of a carrier gas at low pressure. The gas carries a sample to a gas chromatograph column; the column output is directed to a microwave cavity. In this cavity, a low pressure microwave discharge produces fragmentation of the compounds present and generates intense atomic emissions in the vacuum ultraviolet. These emissions are isolated by a monochromator and measured by photometer to establish absolute concentration for the elements. E.H.W.

N72-25429*# National Research Corp., Cambridge, Mass.
LUNAR MASS SPECTROMETER TEST PROGRAM Final Report
F. L. Torney and J. R. Dobrott [1972] 83 p refs (Contract NASw-2114)
(NASA-CR-126772) Avail: NTIS HC $6.25 CSCL 14B

The procedures are described along with results obtained in a test program conducted to demonstrate the performance of a candidate lunar mass spectrometer. The instrument was designed to sample and measure gases believed to exist in the lunar atmosphere at the surface. The subject instrument consists of a cold cathode ion source, a small quadrupole mass analyzer and an off axis electron multiplier ion counting detector. The major program emphasis was placed on demonstrating instrument resolution, sensitivity and S/N ratio over the mass range 0-150 amu and over a partial pressure range from 10 to the minus 9th power to < 10 to the minus 13th power torr. Ultrahigh vacuum tests were conducted and the minimum detectable partial pressure for neon, argon, krypton and xenon was successfully determined for the spectrometer using isotopes of these gases. With the exception of neon, the minimum detectable partial pressure is approximately 4 x 10 to the minus 14th power torr for the above gases. Author

N72-25430# Joint Publications Research Service, Arlington, Va.
GEOPHYSICAL EQUIPMENT
25 May 1972 75 p refs Transl. into ENGLISH from Geofizicheskaya Apparatura (Leningrad), nos. 45, 46, 47, 1971 (JPRS-56099) Avail: NTIS HC $5.75

Articles are presented on various magnetometer designs for measuring weak and very weak magnetic fields and field components, errors and error analysis, and problems associated with airborne and shipborne measurements. For individual titles, see N72-25431 through N72-25439.

N72-25431# Joint Publications Research Service, Arlington, Va.
A QUANTUM FLUXMETER FOR MEASURING WEAK AND VERY WEAK MAGNETIC FIELDS WITH A SUPERCONDUCTING QUANTUM INTERFERENCE SENSOR
Ye. N. Pestov and B. V. Skrotskiy *In its* Geophys. Equipment 25 May 1972 p 1-6 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

Superconducting sensor quantum interference fluxmeters are described based on a toroidal circuit loop with sharp decreases in diameter at diametrically opposite points. The diameter of the circuit is so selected as to have a current which produces a surface magnetic field considerably smaller than the critical field at which the superconducting sensor disintegrates. The contractions in the circuit loop cause the superconducting sensor to disintegrate even with the weak magnetic fields, compensating for the flux. The transition from the superconducting sensor condition to the normal resistive condition is accompanied by the appearance of an active resistance leading to a voltage drop across the section. Current oscillations result from the interference of coherent currents in both circuit branches. Electromagnetic characteristics are given for specific fluxmeters in use and being developed. N.E.N.

N72-25432# Joint Publications Research Service, Arlington, Va.
SPIN PRECESSION EXCITATION BY MEANS OF PHAS. MODULATION OF PUMPING LIGHT c23
V. M. Ryzhkov and L. A. Gerzha *In its* Geophys. Equipment 25 May 1972 p 7-12 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

A self-oscillating magnetometer using modulated polarized light is described. Light from a spectral lamp is collected and fed through a polaroid lens which transmits linearly polarized light into a phase cell. In the cell, the phase difference of the ordinary and extraordinary waves is modulated with Larmor precession frequency from 0 to pi/2 or from -pi/2 to +pi/2. The light is then focused on a photodetector, amplified, and fed back into the phase cell. The system oscillates at precession frequency coupled with the magnetic field through atomic constants. The magnetic field is determined from the measurement of the frequency. The theory and characteristics of this magnetometer and other versions are discussed. N.E.N.

N72-25433# Joint Publications Research Service, Arlington, Va.
CONTINUOUS AUTOMATIC MEASUREMENT OF GEOMAGNETIC FIELD COMPONENTS
A. Ya. Rotshteyn and G. V. Alekseyev *In its* Geophys. Equipment 25 May 1972 p 13-21 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

The errors in measuring geomagnetic field components when auxiliary alternating fields with autocompensation are introduced into a self-oscillating magnetometer system are discussed. The auxiliary fields are applied in directions opposite to the X and Y components. The sensitivity of the autocompensation system is determined from the shape of the signal curve of the quantum magnetometer when the total field is acting on it. Mathematical expressions are developed for describing signal shape and the various error values. N.E.N.

N72-25434# Joint Publications Research Service, Arlington, Va.
ADJUSTMENT OF QUANTUM MAGNETOMETERS WHEN MEASURING GEOMAGNETIC COMPONENTS
A. Ya. Rotshteyn and G. V. Alekseyev *In its* Geophys. Equipment 25 May 1972 p 22-29 (See N72-25430 16-14)
Avail: NTIS HC $5.75

Magnetometer adjustments for theta, the angle between OZ and the axis of revolution, and for eta, the angle between the direction of the auxiliary ring field and the axis of revolution, are discussed. Mechanical and electrical aspects of the adjustments are described. If the geomagnetic components are to be determined from a moving platform, the magnetometer is placed directly on a gyrovertical force line or on a platform maintained in a horizontal plane by a servomechanism from the gyrovertical line. The adjustments needed in this case are also outlined, and a diagram is included of the quantum magnetometer compensating rings on a gyrostabilized platform. N.E.N.

N72-25435# Joint Publications Research Service, Arlington, Va.
GEOGRAPHICAL LIMITATIONS OF AN APPROXIMATE COMPENSATION OF AIRPLANE MAGNETIC FIELDS
V. L. Kantorovich *In its* Geophys. Equipment 25 May 1972 p 30-34 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

Problems involved in airborne magnetometry are discussed which result from the changing inductive field of the aircraft moving through the geomagnetic field with variable direction and

magnitude. The extent to which approximate compensation is maintained with required accuracy is determined. A graph is given illustrating the trend of the latitudinal error variations. A method is also presented for determining the Poisson coefficient which enters into the expression for latitudinal error compensation. N.E.N.

N72-25436# Joint Publications Research Service, Arlington, Va.
QUANTUM MAGNETOMETER WITHOUT ORIENTATION SKIP ZONES
V. M. Ryzhkov and V. S. Solovyev *In its* Geophys. Equipment 25 May 1972 p 35-43 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

Several quantum magnetometer designs and their operation are reviewed, and the magnetization vector motion with the simultaneous action of the modulated light and radio frequency field is examined in detail. A mathematical discussion is given based on an optical pumping equation and assuming that the longitudinal and transverse times of thermal relaxation are equal. In this case the optical pumping time is inversely propertional to light intensity. It is shown that the joint operation of radio frequency field and modulated optical pumping improves the orientation characteristics of both magnetometer circuits. N.E.N.

N72-25437# Joint Publications Research Service, Arlington, Va.
ERRORS IN A DEVICE FOR MEASURING DECLINATION AND INCLINATION ANGLES
L. I. Popkova, A. Ya. Rotshteyn, and S. F. Farmakovskiy *In its* Geophys. Equipment 25 May 1972 p 44-48 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

The instrument errors, when the method of electrical stabilization of the auxiliary magnetic field vector H sub B is used, are due to independent random causes. The basic components of the error are identified as the following: (1) errors in computing components of vector H sub B in the computer-solver, which is the coordinate converter on the sine-cosine revolving tranformers; (2) the error in constructing vector H sub B with the aid of the Helmholtz rings; (3) the error of the quantum magnetometer sensor in the regime of an indicator of perpendicularity between the vector H sub B and the geomagnetic field vector; and (4) the error in the declination and inclination tracking system. These errors are analyzed individually, and the computations are in agreement with experimental results from a magnetometer mockup. N.E.N.

N72-25438# Joint Publications Research Service, Arlington, Va.
DESIGN PRINCIPLES OF OPTICALLY PUMPED MAGNETOMETERS FOR MEASURING VERY WEAK MAGNETIC FIELDS
L. N. Novikov *In its* Geophys. Equipment 25 May 1972 p 49-65 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

The physical design principles of magnetometers based on the optical orientation of atomic moments by polarized resonance light are discussed. The elementary theory of zero magnetic field atomic ground state level crossing effect is described. The simplest model of the power magnetic atom with optical pumping and with an alkali metal atom without nuclear spin is considered. A modulating magnetic field is used to increase the signal to noise ratio for the ground state level crossing signal. Other methods of measuring very weak magnetic fields involve the dependence of the polarization degree of the atom on the angle formed by the external magnetic field vector and the direction of propagation of the circularly polarized light ray; a variable magnetic field whose frequency is smaller than the reciprocal of the relaxation time of the atoms; and a mixture of Hg-199 and Hg-201 pumped by circularly polarized light propagating along an auxiliary magnetic field. N.E.N.

N72-25439# Joint Publications Research Service, Arlington, Va.
ABSOLUTE MARINE COMPONENT MAGNETOMETER
G. V. Alekseyev, S. P. Bakalinskiy, A. Ya. Rotshteyn, and B. M. Tsutskarev *In its* Geophys. Equipment 25 May 1972 p 66-72 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

Analysis of errors of the cesium Z-magnetometer for geomagnetic measurements in seas and oceans, and means of reducing the errors are described. During measurements onboard the nonmagnetic schooner Zarya, the magnetometer was mounted on a gyrovertical device, and the magnetometer was removed as far as possible from the ferromagnetic masses of the gyrovertical device. The quantum magnetometer was controlled in a quiet magnetic field by a nuclear precessional magnetometer. Discrete measurements of Z with the cesium magnetometer were used as the control of the continuous ferrosounding Z-magnetometer, and the differences in their readings are graphed along with the differences between the cesium and nuclear precessional T-magnetometer readings. N.E.N.

N72-25440*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HALL EFFECT MAGNETOMETER Patent Application
John A. Woollam, Harry A. Beale (Maryland Univ.), and Ian L. Spain (Maryland Univ.) Filed 17 May 1972 8 p
(NASA-Case-LEW-11632-1; US-Patent-Appl-SN-254173) Avail: NTIS HC $3.00 CSCL 14B

A magnetometer which uses a single crystal of Bi2Se3 as the sensing element is described. The crystal is grown by the Bridgeman technique and is used as the Hall effect material in the magnetometer. The Bi2Se3 crystal has a rhombohedral structure and a carrier concentration about 10 to the 18th power to 10 to the 20th power per cubic centimeter. The magnetometer has an output voltage which is linear to within one percent for magnetic fields up to at least 8 telsa for a specific constant temperature between 1.2 K and 300 K. The Hall-resistivity versus magnetic field curve has a slope which varies by one percent or less in the region 1.2 K to 35 K and by only 20 percent or less in the region 4 K to 300 K. NASA

N72-25441# Royal Aircraft Establishment, Farnborough (England).
OBSERVATIONS ON THE APPLICABILITY OF A ROTATING MIRROR CAMERA, ESPECIALLY FOR INVESTIGATIONS OF MOVING SELF-LUMINOUS OBJECTS
K. P. Anders May 1972 28 p refs Transl. into ENGLISH of West German report DLR-Mit-70-16
(RAE-Lib-Trans-1621; BR29171; DLR-Mit-70-16) Avail: NTIS HC $3.50

The applicability of a rotating mirror camera for photographing moving self-luminous objects is discussed. The values for the resolution of the camera in space and time are presented. Calculations to determine the blurring caused by rotation of the mirror during the exposure of the picture are included. The possible errors arising in the determination of exposure time are examined. Various photographic techniques used in the investigation into a rotation arc are described and experimental results on the motion of the arc are quoted. Author

N72-25442# Los Alamos Scientific Lab., N.Mex.
FACTORS AFFECTING THE DESIGN OF ALBEDO-NEUTRON DOSIMETERS CONTAINING LITHIUM FLUORIDE THERMOLUMINESCENT DOSIMETERS
Dale E. Hankins Jan. 1972 17 p refs
(Contract W-7405-eng-36)
(LA-4832) Avail: NTIS

Albedo-neutron dosimeters are being considered as a replacement for the NTA film badge and for measuring the neutron dose from intermediate- and low-energy fast neutrons. Factors affecting the design of an albedo-neutron dosimetry system using Li-6 and Li-7 thermoluminescent dosimeters were studied. These factors include energy dependence, sensitivity, orientation with respect to the body, dosimeter-to-body distance, source-to-dosimeter distance, and the presence of shielding materials between the source and the dosimeter. Design variables included incorporation of several thicknesses of polyethylene in

the dosimeter, location of the thermal neutron detectors at nine different positions in or on the dosimeter, and use of differing diameters and thicknesses of cadmium shields in the dosimeters. Proper design of albedo-neutron dosimeters can eliminate many of the problems that have restricted or limited their usefulness.
Author (NSA)

N72-25443# California Univ., Livermore. Lawrence Livermore Lab.
STRAIN GAGING NICKEL PLATED URANIUM
Gerald R. Dittbenner 5 Jan. 1972 7 p refs
(Contract W-7405-eng-48)
(UCRL-51169) Avail: NTIS

Strain-gage data and techniques used on D-38 test beams electroplated with nickel and gold and tested at 75 and 400 F are presented. The strain gages provide accurate measurements when bonded to the nickel-plated uranium surface.
Author (NSA)

N72-25444# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF HYPERSONIC AIR FLOW BY MASS SPECTROMETRY Ph.D. Thesis - Freiburg Univ. [MASSENSPEKTROMETRISCHE UNTERSUCHUNG IN HYPERSCHALL-LUFT-STROEMUNGEN]
H. Trinks 4 Nov. 1971 108 p refs In GERMAN
(ISL-37/71) Avail: NTIS HC $7.50

Mass spectroscopy was applied to the analysis of hypersonic air flow, and a mass spectrometer is described that allows for high resolution simultaneous and continuous determination of the concentration of the components in a gas. Analyses carried out with this spectrometer in a hypersonic shock tube provided information on the evolution of relative concentrations, the duration of blow down time, phenomena arising in the hydrogen-air mixing zone in the wake, and perturbation to measurements caused by membrane fragments. The dissociation rates of nitrogen and oxygen in the upstream flow and at the stagnation point of a hemispheric model were determined and compared with theoretical values. Several ions were qualitatively recognized at stagnation point.
ESRO

N72-25445# Marconi Space and Defence Systems, Ltd., Frimley (England).
A PRELIMINARY DESIGN STUDY FOR A MULTISPECTRAL IR LINE SCANNER FOR USE ON A RESEARCH AND APPLICATIONS MODULE, VOLUME 1
E. J. Becklake, comp. 19 Feb. 1972 102 p 2 Vol.
(Contract ESTEC-1465-71-EL)
(Rept-779/72/1-Vol-1; ESRO-CR(P)-77) Avail: NTIS HC $7.25

A preliminary design concept for a multispectral infrared line scanner for use with the post Apollo program space shuttle earth resources mission was produced and is described. It was found that it was in principle possible to meet the technical specification required, but that in certain cases the requirements are just on the borderline of feasibility. In order to meet the requirements, certain assumptions have had to be made on the future developments of components. For example, it was assumed that trimetal detectors will be available having 1/f noise cut-off frequencies of the order of 800 Hz. It was also assumed that the problems involved in the integration of the detectors, with the cooler cold fingers and the associated microphonically induced noise problems will be successfully solved.
Author (ESRO)

N72-25446# Marconi Space and Defence Systems, Ltd., Frimley (England).
A PRELIMINARY DESIGN STUDY FOR A MULTISPECTRAL IR LINE SCANNER FOR USE ON A RESEARCH AND APPLICATIONS MODULE, VOLUME 2
E. J. Becklake, comp. 19 Feb. 1972 57 p 2 Vol.
(Contract ESTEC-1465-71-EL)
(Rept-779/72/1-Vol-2-Summ; ESRO-CR(P)-78) Avail: NTIS HC $5.00

The preliminary design of a multispectral infrared line scanner for provisional use on a space shuttle CAN type mission is summarized. The design was aimed at a 7 day shuttle mission and very little consideration was given to the eventual use of the equipment in a space station with its 10 year mission. The basic technical specification can theoretically be met by this provisional design; however, the safety factor in certain channels should be reconsidered.
Author (ESRO)

N72-25779*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLANCING INCIDENCE TELESCOPES FOR SPACE ASTRONOMY
John D. Mangus *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 103-106 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17H

N72-25781*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL IMAGE DISSECTOR CAMERA SYSTEM
Bernard L. Johnson *In its* Significant Accomplishment in Technol., GSFC, 1970 1972 p 111-114 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14E

N72-25782*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRECISION DIGITAL SOLAR ASPECT SENSOR
H. P. Scherer *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 115-118 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

N72-25790*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN AND DEVELOPMENT OF A MICROPOUND EXTENDED RANGE THRUST STAND (MERTS)
Kenneth W. Stark *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 145-147 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

N72-25799*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FEASIBILITY MODEL OF A VIDEO INSTRUMENTATION RECORD/REPRODUCE SYSTEM
J. L. Tinsley *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 183-186 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

N72-25382*# Colorado State Univ., Fort Collins.
FIELD TESTS OF THE OPTICAL CROSS BEAM SYSTEM
V. A. Sandborn *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 589-594 ref (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 14B

N72-25388*# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
THE HUDSON LABORATORIES MICROBAROGRAPH SYSTEM: RESULTS AND FUTURE TRENDS
I. Tolstoy and T. Herron *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 693-696 refs (See N72-25347 16-13)
(Contract Nonr-266(84))
(Rept-327) Avail: NTIS HC $37.50 CSCL 14B

N72-25504# Max-Planck-Institut fuer Plasmaphysik, Munich (West Germany).
LASER - A LIGHT SOURCE FOR HIGH SPEED PHOTOGRA-

PHY
K. Buechl *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 22 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

N72-25506# ARO, Inc., Arnold Air Force Station, Tenn. Experimental Research.
APPLICATION OF DUAL SCATTER LASER DOPPLER VELOCIMETERS FOR WIND TUNNEL MEASUREMENTS
A. E. Lennert, F. H. Smith, and R. L. Parker *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 16 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-25447* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICAL INSULATING LAYER PROCESS Patent
Lewis O. Mullen and Donald B. Sullivan, inventors (to NASA) Issued 14 Mar. 1972 4 p Filed 31 Dec. 1969 Supersedes N70-22134 (08 - 09, p 1641)
(NASA-Case-LEW-10489-1; US-Patent-3,649,356; US-Patent-Appl-SN-889682; US-Patent-Class-117-217; US-Patent-Class-29-599; US-Patent-Class-117-62; US-Patent-Class-117-93.16D; US-Patent-Class-117-107; US-Patent-Class-117-211) Avail: US Patent Office CSCL 13H

A method for forming an insulating layer between a pair of electrical conductors is described. The device provides an improved quantum mechanical tunneling layer between adjacent conductors of semiconductor materials. The resulting insulation has the properties of uniform thickness, no pinholes, and stability under wide variations in temperature. P.N.F.

N72-25448* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR PRODUCING DISPERSION STRENGTHENED ALLOYS BY CONVERTING METAL TO A HALIDE, COMMINUTING, REDUCING THE METAL HALIDE TO THE METAL AND SINTERING Patent
Alan Arias, inventor (to NASA) Issued 14 Mar. 1972 6 p Filed 26 Nov. 1969 Supersedes N70-26818 (08 - 13, p 2390)
(NASA-Case-LEW-10450-1; US-Patent-3,649,242; US-Patent-Appl-SN-880271; US-Patent-Class-75/0.5BB; US-Patent-Class-75-213; US-Patent-Class-75-206) Avail: US Patent Office CSCL 13H

Grinding mixtures of powdered metals and inert fillers or dispersoids to submicron-sized powders in a gastight mill filled with a hydrogen halide under pressure is described. The powders are cleaned in hydrogen and compacted.
Official Gazette of the U.S. Patent Office

N72-25449+ Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF STEEL CASTINGS INTENDED FOR GEARS [INSPECAO ULTRA-SONICA DE ARO DE ACO FUNDIDO DESTINADO A USINAGEM DE ENGRENAGEM]
L. X. Nepomuceno 5 May 1971 5 p In PORTUGUESE Supported by Saver S/A Mech. Ind., Rio de Janeiro
(Rept-7105.510) Avail: NTIS HC $3.00

Results of ultrasonic inspection of cast steel rings are presented. The equipment and procedures are described, and photographs of the echograms are included. Transl. by F.O.S.

N72-25450* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QUICK DISCONNECT COUPLING Patent
Allan R. McDougal and Douglas P. Davis, inventors (to NASA) Issued 18 Apr. 1972 8 p Filed 21 Aug. 1970 Supersedes N72-15467 (10 - 06, p 777) Sponsored by NASA
(NASA-Case-NPO-11202; US-Patent-3,656,781; US-Patent-Appl-SN-66004; US-Patent-Class-285-3; US-Patent-Class-285-33; US-Patent-Class-285-316; US-Patent-Class-285-DIG.21; US-Patent-Class-339-45M; US-Patent-Class-339-91B) Avail: US Patent Office CSCL 13E

A quick-disconnect coupling is described that is particularly suited for use in coupling umbilical leads, including electrical cables and fluid conduits and is characterized by a pair of coaxially related coupling components interconnected through an annular array of balls operatively seated within an annular groove and maintained in operative disposition by locking ring. A particular feature is an embodiment which includes a sealed gas generator operatively associated with the locking ring for positively displacing the locking ring, thereby achieving a release of the balls. An axially displaceable, actuating sleeve is coupled with the generator so that the generator also serves to initiate a positive separation of the coupling components as the balls are released. Official Gazette of the U.S. Patent Office

N72-25451* Northrop Nortronics, Palos Verdes Peninsula, Calif.
VALVE SEAT Patent
George L. Root, inventor (to NASA) Issued 25 Apr. 1972 4 p Filed 4 Feb. 1970 Supersedes N70-25622 (08 - 12, p 2214) Sponsored by NASA
(NASA-Case-NPO-10606; US-Patent-3,658,295; US-Patent-Appl-SN-8636; US-Patent-Class-251-360) Avail: US Patent Office CSCL 13I

A valve seat of an annular configuration is described, having a segmented sealing surface including a cylindrical surface extending concentrically through the seat. A substantially full flow throat terminating in outwardly flared conical sealing surface segment is defined. A feature of the seat is the inclusion of a pair of coaxially arranged conical surface segments circumscribing the throat of the valve seat whereby a reduced-stress area sealing surface is provided for receiving a plug. Official Gazette of the U.S. Patent Office

N72-25452* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELECTIVE NICKEL DEPOSITION Patent
Warren H. Philipp, Stanley J. Marsik, and Charles E. May, inventors (to NASA) Issued 25 Apr. 1972 3 p Filed 13 Nov. 1969 Supersedes N70-20720 (08 - 08, p 1451)
(NASA-Case-LEW-10965-1; US-Patent-3,658,569; US-Patent-Appl-SN-876588; US-Patent-Class-117-47R; US-Patent-Class-96-36.2; US-Patent-Class-117-37; US-Patent-Class-117-93.3; US-Patent-Class-117-62; US-Patent-Class-117-152; US-Patent-Class-117-124; US-Patent-Class-117-16R; US-Patent-Class-204-49; US-Patent-Class-204-157.18AG; US-Patent-Class-250-65F) Avail: US Patent Office CSCL 13H

A process is described for selectively depositing nickel by irradiating selected portions of a substrate coated with an irradiation sensitive compound. Immersing the irradiated substrate in a developer deposits controlled amounts of nickel in the selected portions. Official Gazette of the U.S. Patent Office

N72-25453* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
CABLE STABILIZER FOR OPEN SHAFT CABLE OPERATED ELEVATORS Patent
Edwin J. Davis and Bill A. Tolson, inventors (to NASA) Issued 30 May 1972 7 p Filed 6 Aug. 1970 Supersedes N70-41956

(08 - 24, p 4515)
(NASA-Case-KSC-10513; US-Patent-3,666,051;
US-Patent-Appl-SN-61535; US-Patent-Class-187-1;
US-Patent-Class-187-20; US-Patent-Class-254-190) Avail: US Patent Office CSCL 13E

An apparatus for stabilizing the cables used to raise and lower an elevator compartment is described. A guide member through which the cables of the elevator pass is provided for aiding in preventing the cables from swaying in the wind. A pair of stops are carried on the guide rails so as to prevent the guide member from dropping below an intermediate location. When the elevator compartment is raised above the intermediate location such, in turn, causes the guide member to be raised therewith. Official Gazette of the U.S. Patent Office

N72-25454* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FOLDABLE CONSTRUCTION BLOCK Patent
William C. Huber, inventor (to NASA) Issued 30 May 1972 6 p Filed 18 Sep. 1970 Supersedes N72-15470 (10 - 06, p 778)
(NASA-Case-MSC-12233-1; US-Patent-3,665,669;
US-Patent-Appl-SN-73422; US-Patent-Class-52-594;
US-Patent-Class-52-169; US-Patent-Class-52-173) Avail: US Patent Office CSCL 13C

Apparatus and method of construction using foldable building blocks are reported. The apparatus includes an open top construction block foldable from a flat sheet of material to form a container having downwardly extending interlock tabs, with struts being provided between opposite vertical walls and diagonally opposed vertical joints to control horizontal expansion of the block when a solid material is placed therein. Also described is a closed top block foldable from a single sheet of material with interlock tabs extending downwardly from one side wall of the block and interlock tab receiving slots provided in the top of the block. Official Gazette of the U.S. Patent Office

N72-25455* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COAXIAL INJECTOR FOR REACTION MOTORS Patent
Larry L. Larson, inventor (to NASA) Issued 16 May 1972 7 p Filed 16 Mar. 1970 Supersedes N70-35103 (08 - 19, p 3615) Sponsored by NASA
(NASA-Case-NPO-11095; US-Patent-3,662,547;
US-Patent-Appl-SN-19585; US-Patent-Class-60-39.74A;
US-Patent-Class-60-258; US-Patent-Class-239-424) Avail: US Patent Office CSCL 13I

A coaxial injector suited for use in mixing liquid propellants within combustion chambers of reaction motors is described. An annular orifice, of a fixed dimension adapted to deliver liquid oxidizer in an outwardly diverging conical sheet is included. An outwardly converging conical sheet of liquid fuel is caused to experience momentum exchange at an annular intersection. A homogeneous mixture is developed, sheathed within a layer of a fuel-rich mixture for cooling the walls of the associated combustion chamber. Official Gazette of the U.S. Patent Office

N72-25456* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BALL SCREW LINEAR ACTUATOR Patent
Gerald S. Perkins, inventor (to NASA) Issued 2 May 1972 5 p Filed 31 Jul. 1970 Supersedes N72-15468 (10 - 06, p 777) Sponsored by NASA
(NASA-Case-NPO-11222; US-Patent-3,660-704;
US-Patent-Appl-SN-59893; US-Patent-Class-310-80;
US-Patent-Class-310-83; US-Patent-Class-310-68) Avail: US Patent Office CSCL 13I

A compact linear actuator with an elongated output shaft for rectilinear reciprocation is described. The device is electrically operated and uses a ball-screw and nut assembly for producing selected rectilinear motion as the electric motor is energized. The actuator is characterized by the concentricity of the nut and motor which improves the compactness of the actuator and the efficiency of its operation. P.N.F.

N72-25457* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
METHOD AND APPARATUS FOR DETECTING SURFACE IONS ON SILICON DIODES AND TRANSISTORS Patent
Frank J. Cocca, inventor (to NASA) Issued 23 May 1972 7 p Filed 5 Jun. 1970 Supersedes N70-36058 (08 - 19, p 3550)
(NASA-Case-ERC-10325; US-Patent-3,665,307;
US-Patent-Appl-SN-43884; US-Patent-Class-324-158D;
US-Patent-Class-324-158T) Avail: US Patent Office CSCL 14D

A method and apparatus for detecting surface ions on silicon diodes and transistors are discussed. The apparatus comprises a temperature chamber for housing the diode or transistor under test, a power supply, an ammeter and an X-Y recorder. The semiconductor under test is subjected to various low temperatures and the reverse current-voltage characteristic curves of the semiconductor are plotted at each of the temperatures. From the reverse current - voltage characteristic curves, the presence of surface ions can be detected.
Official Gazette of the U.S. Patent Office

N72-25458 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF WELDMENTS AND THICKNESS MEASUREMENT FOR CORROSION CONTROL IN INCONEL TUBES IN CHEMICAL PLANT
L. X. Nepomuceno, M. F. Barbosa, and M. T. Itami 16 Aug. 1971 14 p refs In PORTUGUESE; ENGLISH summary
(TR-7108.533) Avail: Issuing Activity

The adopted procedure and equipment with accessories are described for the ultrasonic inspection of welded Y joints and Inconel tubes in a large chemical plant. The results are presented as well as schematic drawings with defect positioning, accompanied by photos of the observed echograms. Author

N72-25459 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON A COMMON THEORY FOR THE STABILITY OF SELF-ADJOINT AND NON-SELF-ADJOINT MECHANICAL SYSTEMS
H. H. E. Leipholz Dec. 1970 29 p refs
(Rept-64) Avail: Issuing Activity

The concept of the Hamiltonian is generalized in such a way that a bilinear functional results, which plays the role of the Hamiltonian for nonself-adjoint systems. For this generalized Hamiltonian the condition delta V = 0 leads to Galerkin's equations, and the condition det 2nd partial of V with respect to alpha sub i beta subj = det A sub ij to the load frequency relationship. This relationship can be interpreted as a surface in the load frequency space, the projection of which on the load planes yields the stability boundaries, i.e. the buckling loads. The theory was applied to two examples. Author

N72-25460 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF ODD SHAPE, LARGE SIZE STEEL CASTING PARTS
L. X. Nepomuceno and M. F. Barbosa 6 Mar. 1972 11 p refs In PORTUGUESE; ENGLISH summary
(TR-7202.568) Avail: Issuing Activity

The equipment, accessories, and the procedure adopted for the ultrasonic inspection and examination of large size, odd shape, steel cast pieces are described. The results observed are presented, as well as schematic drawings, with defect positioning, accompanied by photos of the observed echograms.
Author

N72-25461 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF VISCOUNT AIRCRAFTERS JOINTS AND LUGS
L. X. Nepomuceno 18 May 1971 8 p
(TR-7105.512) Avail: Issuing Activity

The results of a periodic ultrasonic inspection of the wing spar attachment joints on the Viscount Aircraft CX-AQO are reported. Cracked areas were reinspected and results compared to the results of the previous inspection. Photographs of the echograms are included. F.O.S.

N72-25462 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF WELDMENTS AND STRUCTURE COMPONENTS OF LARGE SIZE DERRICK CRANE
L. X. Nepomuceno and A. Sakamoto 5 Apr. 1971 10 p refs In PORTUGUESE; ENGLISH summary
(TR-6105.506) Avail: Issuing Activity

The results of ultrasonic inspection of the welded joints for two crane beams are reported. The equipment and procedures used are described, and schematics of the beams, and photographs of the echograms are included. Transl. by F.O.S.

N72-25463 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC TESTING OF THE BONDING IN WELDMENT FILLING IN PEGSON MODEL 36-B FORGED STEEL AXLE
L. X. Nepomuceno, A. Sakamoto, and M. F. Barbosa 25 Mar. 1971 5 p refs In PORTUGUESE; ENGLISH summary
(TR-7103.494) Avail: Issuing Activity

Inspected parts are described indicating the equipment, accessories and the procedure adopted. The results are presented, together with schematic drawings. Author

N72-25464*# General Dynamics/Fort Worth, Tex. Applied Research Lab.
EVALUATION AND OPTIMIZATION OF THE ADVANCED SIGNAL COUNTING TECHNIQUES ON WELDMENTS Final Report
B. G. W. Yee, A. H. Gardner, L. Hillhouse, and D. R. Russell 31 Jan. 1972 47 p
(Contract NAS8-27014)
(NASA-CR-123649; FZM-5917) Avail: NTIS CSCL 14D

The signal counting technique with the Delta ultrasonic method is evaluated and optimized for flaw detection in aluminum welds. A comparison is made between the counting and conventional amplitude-gate methods to detect flaws. No conclusion is drawn on the sensitivity of these two methods to detect flaws when the mismatch at the welds is small (25 mils or less). When the mismatch is 25 mils or more, the signal counting method is more sensitive. Of the 24 welded specimens, 50 flaws were found by X-ray inspection and 59 by the Delta method. On 1/4-inch thick welds, X-ray is equal to or slightly more sensitive than Delta method, but on the 1/2-inch thick welds Delta ultrasonic appears more sensitive in flaw detection. Author

N72-25465*# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
LOAD RELIEF AND GUST ALLEVIATION CONTROL STUDY Final Report
R. R. Vieweg Apr. 1972 168 p refs
(Contract NAS8-27009)
(NASA-CR-123646; LMSC-HREC-D225737) Avail: NTIS HC $10.50 CSCL 13I

The results of a study are presented in which a computerized optimal control techique was applied to the synthesis of a load relief control system for an advanced Saturn 5 derivative launch vehicle. This technique included selection of a load relief control law and computerized optimization of the controller gain schedules for a set of preselected adverse synthetic wind speed profiles. The gain optimization was effected using a hybrid optimizer program to minimize (optimize) a direct performance functional which specified the design goal (load relief) in engineering terms (explicit representation of maximum bending moments). Author

N72-25466 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF CAST SAE-65 BRASS
L. X. Nepomuceno and M. F. Barbosa 26 Oct. 1971 5 p In PORTUGUESE; ENGLISH summary
(Rept-7110.541) Avail: NTIS HC $3.00

The adopted procedure, the equipment accessories, and the results are described for the ultrasonic inspection of a set of SAE-65 cast billets. Author

N72-25467 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF CAST BRONZE BARS
L. X. Nepomuceno and M. F. Barbosa 21 Sep. 1970 4 p In PORTUGUESE; ENGLISH summary
(Rept-7009.453) Avail: NTIS HC $3.00

The procedure, instruments, and accessories used to inspect cast bronze bars are outlined. The results are given along with acceptance criteria for the inspected material. Author

N72-25468*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUASI-ONE-DIMENSIONAL COMPRESSIBLE FLOW ACROSS FACE SEALS AND NARROW SLOTS. 1: ANALYSIS
John Zuk, Lawrence P. Ludwig, and Robert L. Johnson Washington May 1972 39 p refs
(NASA-TN-D-6668; E-6819) Avail: NTIS HC $3.00 CSCL 11A

An analysis is presented for compressible fluid flow across shaft face seals and narrow slots. The analysis includes fluid inertia, viscous friction, and entrance losses. Subsonic and choked flow conditions can be predicted and analyzed. The model is valid for both laminar and turbulent flows. Results agree with experiment and with solutions which are more limited in applicability. Results show that a parallel film can have a positive film stiffness under choked flow conditions. Author

N72-25469# Committee on Science and Astronautics (U. S. House).
A METRIC AMERICA
Daniel V. DeSimone (NBS) Washington GSO 1971 188 p refs Presented by NBS to Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., 21 Oct. 1971 Prepared by NBS
Avail: Comm. on Sci. and Astronaut.

The findings of the Committee on Science and Astronautics of the U.S. House of Representatives concerning the advantages of converting industry and science to the metric system of measurements are presented. Subjects discussed are: (1) measurement systems, (2) advantages of the metric system, (3) problems expected during conversion, (4) estimated costs of conversion, (5) conversion techniques followed by Great Britain and Japan, and (6) recommendations and problems requiring early attention. Author

N72-25470*# National Aeronautics and Space Administration, Washington, D.C.
SPUTTERING AND ION PLATING
1972 182 p refs Conf. held at Cleveland, 16 Mar. 1972
(NASA-SP-5111) Avail: NTIS HC $3.00 CSCL 13H

The proceedings of a conference on sputtering and ion plating are presented. Subjects discussed are: (1) concepts and applications of ion plating, (2) sputtering for deposition of solid film lubricants, (3) commercial ion plating equipment, (4) industrial potential for ion plating and sputtering, and (5) fundamentals of RF and DC sputtering. P.N.F.

N72-25471*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIFFUSION WELDING IN AIR Patent Application
Thomas J. Moore and Kenneth H. Holko, inventor (to NASA) Filed 24 Apr. 1972 13 p

(NASA-Case-LEW-11387-1; US-Patent-Appl-SN-247090) Avail: NTIS HC $3.00 CSCL 13H

Solid state welding of a butt joint is described. It is accomplished by fusion welding the peripheral surfaces to form a seal, autogentically cleaning the faying or mating surfaces of the joint, and heating to the diffusion welding temperature in air.

NASA

N72-25472# Bureau of Mines, Washington, D.C.
GRAVITY FLOW OF POWDER IN A LUNAR ENVIRONMENT. 1: PROPERTY DETERMINATION OF SIMULATED LUNAR SOIL
David E. Nicholson Jul. 1971 39 p refs
(BM-RI-7543) Avail: NTIS HC $4.00

The mechanical behavior of fine soils in a lunar environment in engineering gravity-flow bins is studied. The ultrahigh vacuum, absence of moisture, and a lunar gravity one-sixth that of earth gravity represents a unique environment, both advantageous and detrimental to these systems. On earth, moisture and gases contained in powder masses can be responsible for complex descriptions of gravity flow. The properties of a dry soil powder, its behavior under one-dimensional compression, and its torsional and direct shearing strength under earth atmosphere are described. These properties provide the parameters for a finite/element analysis to optimize the design of bins. Author

N72-25473# Bureau of Mines, Washington, D.C.
GRAVITY FLOW OF POWDER IN A LUNAR ENVIRONMENT. 2: ANALYSIS OF FLOW INITIATION
William G. Pariseau 1971 24 p refs
(BM-RI-7577) Avail: NTIS HC $3.25

A small displacement, strain, finite element technique utilizing the constant strain triangle and incremental constitutive equations for elastic-plastic media that are nonhardening and obey a Coulomb yield condition was applied to the analysis of gravity flow initiation in a V-shaped hopper. Three methods of loading were examined. Of the three, the method of computing the initial state of stress in a filled hopper prior to drawdown by adding material to the hopper layer-by-layer is superior. Results of the analysis of a typical hopper problem show that the initial state of stress, the elastic moduli, and the strength parameters have an influence on material response subsequent to the opening of the hopper outlet. Author

N72-25474*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
IMPROVED TIG WELD JOINT STRENGTH IN ALUMINUM ALLOY 2219-T87 BY FILLER METAL SUBSTITUTION
R. M. Poorman and C. V. Lovoy 10 May 1972 43 p refs
(NASA-TM-X-64659) Avail: NTIS HC $3.75 CSCL 13H

The results of an investigation on weld joint characteristics of aluminum alloy 2219-T87 are given. Five different alloys were utilized as filler material. The mechanical properties of the joints were determined at ambient and cryogenic temperatures for weldments in the as-welded condition and also, for weldments after elevated temperature exposures. Other evaluations included hardness surveys, stress corrosion susceptibility, and to a limited extent, the internal metallurgical weld structures. The overall results indicate that M-943 filler weldments are superior in strength to weldments containing either the standard 2319 filler or fillers 2014, 2020, and a dual wire feed consisting of three parts 2319 and one part 5652. In addition, no deficiencies were evident in M-934 filler weldments with regard to ductility, joint strength after elevated temperature exposure, weld hardness, metallographic structures, or stress corrosion susceptibility.

Author

N72-25475*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: CERTIFICATION TEST PROGRAM
Joseph H. Levine and Bill J. McCarty Washington Jun. 1972 15 p
(NASA-TN-D-6857; MSC-S-330) Avail: NTIS HC $3.00 CSCL 14D

A review of the Apollo spacecraft certification (qualification) test program is presented. The approach to devising the spectrum of dynamic and climatic environments, the formulation of test durations, and the relative significance of the formal certification test program compared with development testing and acceptance testing are reviewed. Management controls for the formulation of test requirements, test techniques, data review, and acceptance of test results are considered. Significant experience gained from the Apollo spacecraft certification test program which may be applicable to future manned spacecraft is presented. Author

N72-25476*# Midwest Research Inst., Kansas City, Mo.
SOLID LUBRICANTS: A SURVEY Technology Utilization
M. E. Campbell Washington NASA 1972 140 p refs
(Contract NASw-1998)
(NASA-SP-5059(01); LC-78-176235) Avail: NTIS; SOD $0.75 CSCL 11H

A survey is presented of the most recent developments and trends in the field of solid lubrication. Topics discussed include: a history of solid lubrication, lubricating solids, bonded lubricants, new developments, methods of evaluation, environmental effects, application methods, novel materials, and designs for the use of solid lubricants. Excerpts of solid lubricant specifications and a discussion of contact stresses imposed on specimens in three types of test machines used for the evaluation of solid lubricants are presented. Author

N72-25477# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE STABILITY PROBLEM IN ROTATING UNEVEN SHAFTS UNDER TORSION Ph.D. Thesis [ZUM PROBLEM DER STABILITAET ROTIERENDER UNRUNDER WELLEN UNTER TORSION]
Benno R. Buchser 1971 75 p refs In GERMAN
(Diss-4623) Avail: NTIS HC $5.75

The effects of torsion moments on critical speed of rotating uneven shafts are studied by formulating a dynamic model with finite degree of freedom and by considering noncircularity and damping in the differential motion equations for various loads and moment vectors. A Liapunov-type linear differential equation system is formulated for the stability solution that is integrable for the case with constant time coefficients; a convergent double series method is applied to find a solution for the case of periodic coefficients. The computer program for evaluating stability tables is included. Transl. by G.G.

N72-25478*# Applied Magnetics Corp., Goleta, Calif.
PROCESSING AND PLATING HELICAL METALLIC COILS Final Report
5 Apr. 1972 10 p
(Contract NAS5-11675)
(NASA-CR-122418) Avail: NTIS HC $3.00 CSCL 13H

The results of research efforts to develop an optimized nickel cobalt coating suitable as a recording medium are outlined. The coating is to be used directly on a BeCu helical coil substrate of a helical coil NASA recorder. Specifically, efforts were made to: optimize the coating thickness; establish processes and techniques adaptable for the production of finalized plated helical coils; design and fabricate the equipment required for production and testing of the coils; and deliver finalized helical coils to NASA. Author

N72-25479*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR WELDING BLADES TO ROTORS Patent Application
Kenneth H. Holko and Thomas J. Moore, inventors (to NASA) Filed 24 Apr. 1972 12 p

(NASA-Case-LEW-10533-2; US-Patent-Appl-SN-247055) Avail: NTIS HC $3.00 CSCL 13H

The use of magnetic force upset welding to form T-joints between parts of dissimilar thicknesses is discussed. This type of resistance welding is used to join compressor and turbine parts, thereby reducing the weight and cost of a jet engine. NASA

N72-25480*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OMNIDIRECTIONAL WHEEL Patent Application
Josef F. Blumrich, inventor (to NASA) Filed 17 Apr. 1972 18 p
(NASA-Case-MFS-21309-1; US-Patent-Appl-SN-244519) Avail: NTIS HC $3.00 CSCL 13I

The apparatus of the invention consists of a wheel having a hub with radially disposed spokes which are provided with a number of circumferential rim segments. These rim segments carry, between the spokes, rim elements which are rigid relative to their outer support surfaces, and defined in their outer contour to form a part of the circle forming the wheel diameter. The rim segments have, for each of the rim elements, an independent drive selectively operable when the element is in ground contact to rotatably drive the rim element in a direction of movement perpendicularly lateral to the normal plane of rotation and movement of the wheel. This affords the wheel omnidirectional movement. NASA

N72-25481# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ION MICROPROBE ANALYSIS OF HYDROGEN IN TITANIUM IN RELATION TO THE MASSIVE VOID PROBLEM IN ELECTRON BEAM WELDS
P. Adler and John Kennedy Jun. 1972 44 p refs
(RM-545) Avail: NTIS HC $4.25

Ion microprobe analysis was utilized to investigate the role of hydrogen in the formation of massive voids during electron beam welding of titanium and to evaluate the effect of selected treatments on hydrogen contamination and elimination. Localized measurements of hydrogen concentration were made on simulated massive void specimens, prepared by hydrogen charging and welding, as well as on samples exposed to various processing conditions. While applicable for analysis near surfaces, the approach does not appear effective for surface evaluation of hydrogen in titanium. Hydrogen enrichment was observed near massive voids, which indicates that hydrogen does play a significant role in the formation of voids in hydrogen-charged specimens. Vacuum annealing was most effective in reducing the hydrogen concentration, whereas air annealing caused significant increases. The milling, cleaning, and pickling treatments that were evaluated were not found to be sources of hydrogen. Author

N72-25482*# Denver Research Inst., Colo. Industrial Economics Div.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN INDUSTRY: A TECHNOLOGY TRANSFER PROFILE, NONDESTRUCTIVE TESTING
Apr. 1972 109 p refs
(Contract NSR-06-004-063)
(NASA-CR-126574) Avail: NTIS HC $7.50 CSCL 14D

The development of nondestructive testing procedures by NASA and the transfer of nondestructive testing to technology to civilian industry are discussed. The subjects presented are: (1) an overview of the nondestructive testing field, (2) NASA contributions to the field of nondestructive testing, (3) dissemination of NASA contributions, and (4) a transfer profile. Attachments are included which provide a brief description of common nondestructive testing methods and summarize the technology transfer reports involving NASA generated nondestructive testing technology. Author

N72-25483# Battelle Memorial Inst., Columbus, Ohio. Electrochemical Engineering Technology Div.
NONTRADITIONAL MACHINING OF BERYLLIUM
Jan. 1972 91 p refs Sponsored by AFML
(AD-738271; MCIC-72-03) Avail: NTIS CSCL 13/8

The report deals with electrochemical machining (ECM), chemical milling, and electric-discharge machining (EDM). The general characteristics of these processes and their applications to the processing of beryllium parts are presented and covered in detail. GRA

N72-25484# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
GAS GENERATING AND CHARGING EQUIPMENT Final Report
1 Mar. 1972 5 p Supersedes MTP-9-3-136
(AD-738120; TOP-9-3-313) Avail: NTIS CSCL 13/7

The report describes a method for evaluation of gas generating and charging equipment operational and functional performance characteristics. It identifies supporting tests, facilities, and equipment required and provides procedures for functional suitability tests. It is applicable to gaseous oxygen and nitrogen, and liquid carbon dioxide, oxygen, and nitrogen, generating and charging equipment. GRA

N72-25765*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A ROTARY ACTUATOR FOR SPACE MISSIONS
E. J. Devine *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 45-47 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 13I

N72-25803*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
USING THE SCANNING ELECTRON MICROSCOPE ON THE PRODUCTION LINE TO ASSURE QUALITY SEMICONDUCTORS
John W. Adolphsen and Robert J. Anstead *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 199-202 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14D

N72-25804*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAPRECISION TOOL POSITIONER
Ewald E. Schmidt *In* Its Significant Accomplishments in Technol., GSFC, 1970 1972 p 203-205 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 13I

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-25485* National Aeronautics and Space Administration, Washington, D.C.
OPTICAL PUMP AND DRIVER SYSTEM FOR LASERS Patent
Horace W. Furumoto and Harry L. Ceccon, inventors (to NASA) Issued 25 Apr. 1972 7 p Filed 21 May 1970 Supersedes N70-34554 (08 - 18, p 3360)
(NASA-Case-ERC-10283; US-Patent-3,659,225;
US-Patent-Appl-SN-39185; US-Patent-Class-332-7.51;
US-Patent-Class-331-94.5) Avail: US Patent Office CSCL 20E

A laser pumping system is described that includes a xenon-filled coaxial flashlamp mounted on a driver assembly, a cylindrical capacitor and an integrally mounted spark gap switch.

Low inductance plates are used to connect the driver to the flashlamp. Because of low inductance circuitry and the use of a switch to prevent premature breakdown of the xenon gas, an extremely uniform high power discharge is created in the flashlamp by a photoionization process.
Official Gazette of the U.S. Patent Office

N72-25486*# Texas Univ., Austin.
LUNAR LASER RANGING DATA DEPOSITED IN THE NATIONAL SPACE SCIENCE DATA CENTER: UNFILTERED PHOTON DETECTIONS FOR SEPTEMBER 1969 THROUGH JUNE 1970
J. Derral Mulholland Sep. 1971 7 p refs
(Grant NGR-44-012-219)
(NASA-CR-126747; RM-71-001) Avail: NTIS HC $3.00 CSCL 20E

Documentation is presented which is to be used in conjunction with the deposition in the National Space Science Data Center of the unfiltered data obtained during laser ranging operations between the McDonald Observatory and the reflector at Tranquility Base during the interval September 1969 through June 1970. Author

N72-25487# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
A LASER TECHNIQUE FOR INVESTIGATING THE EFFECTS OF THERMAL TRANSIENTS ON PRESSURE TRANSDUCER PERFORMANCE CHARACTERISTICS
Paul S. Lederer and John S. Hilten May 1972 44 p refs
(AEC Order SAN-71-325; NBS Proj. 4253440)
(NBS-TN-723) Avail: SOD $0.45 as C13.46:723

A testing technique was developed which makes it practical to obtain information on the zero shift and change in sensitivity of a pressure transducer while it is subjected to a thermal transient generated by a mechanically chopped cw laser beam. Several commercial, flush diaphragm, pressure transducers with ranges up to 50 psi were tested and showed zero shifts and changes in sensitivity of the order of 20% FS due to thermal transients with power densities up to 100 kilowatts per square meter pressure cycled while it is irradiated. In this way, zero shifts and sensitivity changes may be directly displayed in a procedure which requires a testing time of only about one minute. Author

N72-25488*# United Aircraft Corp., East Hartford, Conn.
RESEARCH AND INVESTIGATION OF GAS DYNAMIC LASERS Final Report, 10 Feb. - 10 Oct. 1971
L. R. Boedeker and B. R. Bronfin Washington NASA 10 Nov. 1971 64 p refs
(Contract NASw-2181)
(NASA-CR-126718; UARL-K911106-4) Avail: NTIS HC $5.25 CSCL 20E

Chemical mixing laser investigations were conducted (1) to investigate the properties of a bimolecular exchange laser system pumped by the H + Cl2 yields HCl(v) + Cl reaction, initiated by arc dissociated H2, with lasing occurring between lambda = 3.4 and 4.0 microns, and 2) to establish the feasibility of an atom recombination transfer laser employing recombination of arc dissociated nitrogen with subsequent transfer of vibrational energy to CO2 for lasing at 10.6 microns. Diagnostic and analytical results showed that the reaction mechanism during mixing, a back reaction of HCl(v) with H atoms, reaction of Cl with H2(v), moderately fast V-V, V-T processes, and possible HCl(o) initial contaminant level, are among the key features which may explain the low level of performance. Atom recombination transfer experiments employed quenching of arc-dissociated N2 in a plenum wherein transit of recombined N2 is fast relative to N2 vibrational decay at the quenched temperature. Nitrogen-CO2 thermal mixing laser studies were extended to measure the efficiency of transfer of recombination energy in a nonequilibrium N2 source to 10.6 microns optical energy. Author

N72-25489*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CHEMICAL LASER Patent Application
William R. Downs, inventor (to NASA) Filed 3 Jan. 1972 27 p
(NASA-Case-MSC-10986-2; US-Patent-Appl-SN-215076) Avail: NTIS HC $3.50 CSCL 20E

Chemical lasers are described using chemical reactions at low or zero gravity. These are intended for the continuous production of high intensity light and/or power in orbital space flight. NASA

N72-25490*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHORT RANGE LASER OBSTACLE DETECTOR Patent Application
William L. Kuriger, inventor (to NASA) Filed 16 Mar. 1972 25 p refs Sponsored by NASA
(NASA-Case-NPO-11856-1; US-Patent-Appl-SN-235268) Avail: NTIS HC $3.25 CSCL 20E

A short range obstacle detector for surface vehicles is provided by an array of laser diodes operated one at a time, one for each of a number of adjacent azimuth sectors. A vibrating mirror a short distance above the surface provides continuous scanning in elevation for all azimuth sectors. A diode laser selector is synchronized with the vibrating mirror to enable one diode laser to be fired by pulses from a clock pulse source a number of times during each elevation scan cycle. The time for a given pulse of light to be reflected from an obstacle and received is a measure of range to the obstacle. NASA

N72-25491*# Smithsonian Institution, Washington, D.C.
CAVITY RESONATOR FOR HYDROGEN MASER Patent Application
Robert F. C. Vessot, Thomas E. Hoffman, inventors (to NASA), and Martin W. Levine Filed 20 Mar. 1972 11 p
(Contract NSR-09-015-098)
(NASA-Case-HQN-10790-1; US-Patent-Appl-SN-235962) Avail: NTIS HC $3.00 CSCL 20E

A cavity for a hydrogen maser is disclosed consisting of three parts which provide highly stable mechanical and thermal expansion characteristics for the cavity and ease of tuning. The three parts which are made of glass ceramic material having a very small thermal expansion coefficient. These include a top plate, a cylinder with three interrupted helical ramps at its bottom, and a base which includes a bottom plate and three ramp lugs on which the helical ramps of the cylinder rest when the cylinder is placed on the base with the bottom plate in the cylinder. Cavity tuning is achieved by rotating the cylinder and thereby raising or lowering it on the base, which results in changing the cylinder volume by changing the distance between the bottom and top plates. NASA

N72-25492*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INITIATION OF INSENSITIVE EXPLOSIVES BY LASER ENERGY
Vincent J. Menichelli and Lein C. Yang 1 Jun. 1972 23 p refs
(Contract NAS7-100)
(NASA-CR-126741; JPL-TR-32-1557) Avail: NTIS HC $3.25 CSCL 20E

Instantaneous longitudinal detonations were observed in confined columns of pentaerythritol tetranitrate (PETN), cyclotrimethylene trinitramine (RDX), and tetryl when these materials were pulsed with light energy from a focused Q-switch ruby laser. The laser energy ranged from 0.5 to 4.2 J with a pulse width of 25 ns. Enhancement of the ignition mechanism is hypothesized when a 100-nm (1000-A) thick aluminum film is vacuum-deposited on the explosive side of the window. Upon irradiation from the laser, a shock is generated at the aluminum explosive interface. Steady state detonations can be reached in less than 0.5 microseconds with less than 10% variation in detonation velocity for PETN and RDX. Author

N72-25493# Advisory Group for Aerospace Research and Development, Paris (France).
LASER TECHNOLOGY IN AERODYNAMIC MEASUREMENTS AGARD Lecture Series
R. C. Pankhurst, ed. Mar. 1972 249 p refs Presented at Rhode-Saint-Genese, Belgium, 14-18 Jun. 1971; sponsored by AGARD. Fluid Dyn. Panel and von Karman Inst. for Fluid Dyn.
(AGARD-LS-49) Avail: NTIS HC $14.50

The proceedings of a conference on the use of lasers for measuring aerodynamic applications are presented. The subjects discussed are: (1) principles of holography, (2) mathematical methods in coherent optical systems analysis, (3) laser beams for aerodynamic flow field analysis, (4) laser Doppler velocimeters for wind tunnel applications, (5) laser applications for high speed photography, and (6) laser metrology. For individual titles, see N72-25494 through N72-25506.

N72-25494# Tennessee Univ., Tullahoma. Space Inst.
AN INTRODUCTION TO THE LASER
T. H. Gee *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 5 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

The basic principles of laser operation are discussed. The properties which characterize its performance as a source of quasi-monochromatic radiation in and near the visible range of the electromagnetic spectrum are described. The various materials which are used for lasers and the construction of the resonant cavity are explained. The three classes of energy levels are discussed and schematic representations are included. Author

N72-25495# Tennessee Univ., Tullahoma. Space Inst.
PRINCIPLES OF HOLOGRAPHY
T. H. Gee *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 13 p ref (See N72-25493 16-16)
Avail: NTIS HC $14.50

The principles of holography are discussed. Holography is the process of recording complex wavefronts of light scattered by a scene (object) and subsequent release of the recorded wavefronts to reconstruct the original scene. The reconstruction contains all of the geometrical characteristics of the original scene which one would observe by viewing the scene through a window whose dimensions are those of the recording medium. The basis of the recording process is interferometry. A complex wavefront is made to interfere with a known reference wave and the result recorded by a square law detector. Author

N72-25496# Tennessee Univ., Tullahoma. Space Inst.
MATHEMATICAL METHODS IN COHERENT OPTICAL SYSTEMS ANALYSIS. FIRST ORDER ANALYSIS OF A HOLOGRAPHIC SCHLIEREN SYSTEM
T. H. Gee *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 7 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

The mathematical methods employed in the analysis of coherent optical systems are demonstrated by an illustrative example. This example involves an optical configuration which may be employed as a holographic Schlieren system, and illustrates the Fourier transform properties of positive thin lens, hologram formation and reconstruction, magnification and various approximations which are normally made in a first order analysis. The coherent optical configuration is presented. Author

N72-25497# Queens Univ., Belfast (Northern Ireland).
EFFECTS OF COHERENCE ON FLOW VISUALIZATION METHODS c12
L. H. Tanner *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 2 p (See N72-25493 16-16)
Avail: NTIS HC $14.50

The application of coherent light to flow visualization procedures is discussed. Diagrams illustrating the differences between thermal light sources and coherent light sources are presented. The advantages of laser light over conventional light are described and mathematical models are included to support the theoretical considerations. Author

N72-25498# ARO, Inc., Arnold Air Force Station, Tenn.
AERODYNAMIC HOLOGRAPHY
J. D. Trolinger *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 18 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

Applications of holography in aerodynamics and related mechanics are discussed. Included are holographic generalized flow visualization, interferometry, and three-dimensional recording. The high resolution analysis of dynamic nearly transparent three-dimensional field of light scattering elements is described. Specific applications of particulate matter in explosions, plasmas, rocket and engine exhausts, and in wind tunnel and similar research facilities are examined. It is concluded that holography provides data not obtainable by other means and has economic and technical advantages over conventional means of data acquisition. Author

N72-25499# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
EXPERIMENTAL HOLOGRAPHY
J. Upatnieks *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 8 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

The formation of a hologram and the recording of the interference pattern between a reference beam and the light waves reflected from an object or scene are discussed. Holography is interferometry and the technology of this subject applies to holography as well. The factors affecting the formation of the hologram, the quality and characteristics of reconstructed images, and various optical systems for constructing holograms are considered. Author

N72-25500# Michigan Univ., Ann Arbor. Radar and Optics Lab.
CHARACTERISTICS OF DIELECTRIC HOLOGRAMS
J. Upatnieks and C. D. Leonard *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 9 p refs (See N72-25493 16-16)
(Contracts F33615-67-C-1814; F33615-68-C-1310)
Avail: NTIS HC $14.50

The diffraction efficiency and signal-to-noise ratio for two-dimensional and volume diffuse-signal-beam holograms are calculated and experimentally determined. Calculations are based on the statistical properties of the signal beam, and exact integrals rather than series approximations are used. High signal-to-noise ratio and high diffraction efficiency are possible, with the peak calculated diffraction efficiency being 22% for two-dimensional and 64% for volume holograms. The experimentally achieved efficiencies were 12% for two-dimensional and 36% for volume holograms. Author

N72-25501*# TRW Systems Group, Redondo Beach, Calif.
PULSED LASER HOLOGRAPHY
R. F. Wuerker and L. O. Heflinger *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 14 p refs Previously published in The Eng. Uses of Holography by E. R. Robertson and J. M. Harvey Cambridge Univ. Press. 1970 (See N72-25493 16-16)
(Contracts NASw-1572; JPL-952023; F04611-67-C-0105; F33615-68-C1119)
(NASA-CR-126767) Avail: NTIS HC $3.00 CSCL 20E

The development of optical systems used in holography which compensate for the limited spatial temporal coherence of Q-switched ruby laser illuminators is discussed. The employment of the equipment to record projectiles in flight, aerodynamic wakes, and electric discharge plasmas is described. Diagrams and drawings are supplied to show the construction and operation of the system. P.N.F.

N72-25502# TRW Systems Group, Redondo Beach, Calif.
RUBY LASER HOLOGRAPHY
R. F. Wuerker and L. O. Heflinger *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 13 p refs Repr. from SPIE J., v. 9, 1971 p 122-130; also from Proc. of the Conf. in Anaheim, Calif., 14-17 Sep. 1971 (See N72-25493 16-16)
(Contract F33615-69-C-1630)
Avail: NTIS HC $14.50

The solid state ruby laser for recording of holograms without either the granite tables or vibration isolation equipment needed with gas lasers is discussed. The ruby laser is unique in that it can be made to emit several joules of light in a tenth of a microsecond. In their more conventional form, these lasers are not particularly coherent, due to the width of the ruby R sub 1 lasing transition. Temporal coherence can be as low as one centimeter. The development of holographic configurations which compensated for the limited spatial and temporal coherence of ruby lasers is considered. These were used to record transmission holograms of combustion in rocket engines, aerodynamic flow patterns, and particulate matter in coal furnaces. Author

N72-25503# Institut Franco-Allemand de Recherches, St. Louis (France).
LASER BEAM PROBING FOR AERODYNAMIC FLOW FIELD ANALYSIS **c12**
Bernard Koch *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 20 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

The application of laser beams for the measurement of aerodynamic flow fields at supersonic and hypersonic speeds is discussed. The subjects presented are: (1) basic methods of optoelectronic flow field probing, (2) single beam techniques, (3) small diameter beam method for supersonic free jet investigation, (4) twin or multiple beam techniques, (5) crossing beam method, (6) multiple beam interferometry, and (7) Doppler-difference method. Author

N72-25504# Max-Planck-Institut fuer Plasmaphysik, Munich (West Germany).
LASER - A LIGHT SOURCE FOR HIGH SPEED PHOTOGRAPHY **c14**
K. Buechl *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 22 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

The application of lasers as an indirect light source for high speed photography is discussed. Examples of such applications are laser produced plasmas for vacuum ultraviolet light sources or electron sources, ultrafast trigger and calibration of image converter cameras, and a light gated Kerr cell. The characteristics of lasers for photographic use are described and mathematical models are included to support the theoretical considerations. Author

N72-25505# ARO, Inc., Arnold Air Force Station, Tenn. Experimental Research.
LASER METROLOGY
A. E. Lennert, D. B. Brayton, F. L. Crosswy, W. H. Goethert, and H. T. Kalb *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 98 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

The development of a laser Doppler velocity instrument to measure velocities of flowing fluids is discussed. The electro-optical instruments are being developed for enhancing the measuring capabilities in wind tunnels. The basic design parameters of the input aligned optics LDV system and, in particular, the development of a self-aligning system to obviate the basic problems inherent with previously conceived systems, are described. The design and the progress made on a direct readout system to determine three orthogonal components of velocity directly are presented. A number of significant proof-of-principle experiments covering a wide variety of flows, both liquid and gaseous, are discussed. The results of a number of wind tunnel calibrations verifying the superior performance of the LDV for not only velocity determination but also to perform boundary layer measurements are also included. Author

N72-25506# ARO, Inc., Arnold Air Force Station, Tenn. Experimental Research.
APPLICATION OF DUAL SCATTER LASER DOPPLER VELOCIMETERS FOR WIND TUNNEL MEASUREMENTS **c14**
A. E. Lennert, F. H. Smith, and R. L. Parker *In* AGARD Laser Technol. in Aerodyn. Meas. Mar. 1972 16 p refs (See N72-25493 16-16)
Avail: NTIS HC $14.50

A duel scatter laser Doppler velocimeter (LDV), used in both forward and back scatter modes, and a direct data readout system are described. The characteristics of the dual scatter system are such that no seeding of flow is required to effect the measurements. With minor modifications and improvements, the dual scatter LVD system, both forward and back scatter, supplants conventional measuring devices. Descriptions of the application of the instrument to actual wind tunnel measurements including calibration of a one-foot transonic wind tunnel, flow field measurements of a simulated helicopter downwash, and flow field mapping across a high lift wing section are included. Author

N72-25507# Institut Franco-Allemand de Recherches, St. Louis (France).
APPLICATION OF HOLOGRAPHY TO THE VISUALIZATION OF HIGH-SPEED OBJECTS Final Report, 1971
P. Smigielski 29 Dec. 1971 68 p refs In FRENCH; ENGLISH summary
(Contract DRME-71.34.104)
(ISL-41/71) Avail: NTIS HC $5.50

By means of a very precise micromotion generator, it was possible to check the theoretical results. Based on the interference action noticeable in the image reconstruction process, the limits set to high-speed holography were determined as functions of the parameters of the elliptical device, as well as of the object and hologram sizes. Considering diffraction, geometrical abberations, and blurring caused by motion, a set-up was designed and built that, for a resolution of 40 micrometers, allows for holographic recording of projectiles travelling at a velocity of 2 km/sec. For the holographic recording, a single mode Q switched ruby laser was used providing an output pulse of 100 mJ in 20 nsec. The wavelength of the reconstruction differs from that of the picture. Author (ESRO)

N72-25508# Defence Research Information Centre, Orpington (England).
PULSED CO2 LASER WITH HIGH PRESSURE GAS MIXTURE
N. G. Vason, E. M. Velenov et al Jan. 1972 5 p refs Transl. into ENGLISH from Quantovaya Elektron. (USSR), v. 3, 1971 p 121-122
(AD-738270; DRIC-Trans-2644; BR30016) Avail: NTIS CSCL 20/5

The report studies the effect of high pressure in a gas laser in order to obtain powerful light pulses. GRA

N72-25509# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
RECOLLIMATION OF A LASER BEAM Technical Report, Apr. 1968 - Jan. 1971
David G. Clute Aug. 1971 27 p refs
(AF Proj. 6263)
(AD-738288; AFAL-TR-71-121) Avail: NTIS CSCL 20/6

The significance of this analysis to the Air Force is to show that for certain applications ancillary optics must be used with the laser to provide useful collimation of the laser energy. While radiation directly from a laser is inherently collimated, the degree of collimation is limited by the exit aperture of the laser and by other characteristics peculiar to the laser as a generator of

optical energy. In certain applications of the laser, such as long range photography, light radiating directly from the device is not sufficiently collimated to be useful. By employing additional optical elements, light from the laser can be recollimated to provide the desired performance. Selection and design of the ancillary optics is discussed in the report as well as the limitations to recollimation of radiation from a laser.
Author (GRA)

N72-25510# Lockheed-Georgia Co., Marietta.
VELOCITY OF PARTICULATE IN LAMINAR AND TURBULENT GAS FLOW BY HOLOGRAPHIC TECHNIQUES Final Report
J. B. Allen and D. M. Meadows Oct. 1971 128 p
(Contract EPA-EHSD-71-34)
(PB-206950; APTD-0918) Avail: NTIS HC $3.00 CSCL 14E

A technique for measuring the velocity and behavior of particulates suspendent in potential and turbulent air flows, by means of double-pulsed holography is presented. Descriptions of the air duct facility, particulate dispenser, and holographic systems are provided as well as discussions of experimental results and theoretical considerations. Double-pulsed holography proved to be an excellent technique for measuring the characteristics of suspended particulate of size greater than 6 microns. The measurable characteristics include velocity, three-dimensional coordinates of the particle, size, and shape. Specific experiments were performed to determine the feasibility of the double-pulsed holographic technique. These experiments included studies of particulate behavior in electrostatic fields, in potential and turbulent flow, and around a sampling probe for various sampling conditions. Author (GRA)

N72-25771*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 10, 6-MICROMETER LASER RECEIVER RF SUBSYSTEM
D. E. Santarpia *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 71-73 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

N72-25784*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER-AIDED CO2 LASER CAVITY-LENGTH SELECTION FOR REDUCED LINE COMPETITION
G. Schiffner *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 122-125 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

N72-25792*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPROVED LASER RANGING ACCURACY THROUGH DYNAMIC THRESHOLD COMPENSATION
T. S. Johnson *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 152-155 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

N72-25802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG RANGE LASER TRAVERSING SYSTEM
Louis O. Caudill *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 196-198 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

N72-25355*# Sylvania Electronic Systems-East, Waltham, Mass.
INCOHERENT AND COHERENT CW LASER SYSTEMS FOR REMOTE ATMOSPHERIC PROBING
R. F. Lucy *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 125-132 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20E

N72-25357*# Stanford Research Inst., Calif.
LIDAR
R. T. H. Collis *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 147-171 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20E

N72-25358*# New York Univ., N.Y. Geophysical Sciences Lab.
SOME ASPECTS OF REMOTE ATMOSPHERIC SENSING BY LASER RADAR
Richard M. Schotland *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 179-200 refs (See N72-25347 16-13)
(Contrib-62) Avail: NTIS HC $37.50 CSCL 20E

N72-25359*# West Indies Univ., Kingston (Jamaica). Dept. of Physics.
THE LASER RADAR ABOVE 30 KILOMETERS
B. R. Clemesha *In* NAS-NAC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 201-206 refs (See N72-25347 16-13)
(Grant AF-AFOSR-616-67)
Avail: NTIS HC $37.50 CSCL 20E

N72-25361*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
COMMENTS ON BISTATIC LIDAR
John A. Reagan *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 213-215 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 20E

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-25511 Kentucky Univ., Lexington.
GROUP SEPARATION TECHNIQUES FOR THE DETERMINATION OF NOBLE METALS Ph.D. Thesis
David Eugene Gillum 1971 164 p
Avail: Univ. Microfilms Order No. 71-25893

A separation scheme was developed for the determination of a series of noble metals in the same small geochemical sample. It was possible to determine iridium, cobalt, nickel, gold, platinum, silver, and ruthenium in a 100 mg meteorite sample. Iridium, cobalt, and nickel may be determined by nondestructive gamma-gamma coincidence counting. Platinum was determined by counting Au-199. A radiochemical separation for gold utilizing the technique of substoichiometric separation was developed. Ruthenium was separated as the tetroxide by distillation from a sulfuric acid solution using sodium bromate as the oxidizing agent. The radiochemical separation of silver was carried out by a rapid ion exchange procedure with Dowex 1-X8 resin. Replicate analyses for gold and platinum were made on 39 selected chondritic meteorite samples. Replicate analyses for silver and ruthenium were made on 11 and 8 selected meteorites, respectively. Gold and platinum were found to be positively correlated in all meteorites analyzed. Dissert. Abstr.

N72-25512 Waterloo Univ. (Ontario). Solid Mechanics Div.
FATIGUE AND CREEP FAILURE OF ALPHA-IRON AT 450-700 C
H. J. Westwood and D. M. R. Taplin Sep. 1971 28 p refs
Presented at Can. Conf. of Metallurgists, Montreal, Aug. 1971

Sponsored by Natl. Res. Council of Can. and Def. Res. Board of Can.
(TN-10) Avail: Issuing Activity

In the creep tests, the ductility decreased with increase of temperature and the fracture changed from ductile to relatively brittle. The increased brittleness was associated with an increased contribution of grain boundary sliding to the overall deformation. In the fatigue tests, the cycles to failure decreased with temperature increase and the fracture changed from mixed transgranular and intergranular to almost entirely intergranular. At higher temperatures, there was marked tendency for grain boundaries to become aligned preferentially at about 45 deg to the stress axis. Interrupted tests at 700 C showed that failure in both tests was due to the nucleation, growth and linkage of grain boundary cavities. In the creep tests, cavitation began at low strains and complete grain facets readily became cavitated. Triple points, however, appeared to be effective barriers to further crack propagation until quite late in the specimen life. In the fatigue tests, no cavitation occurred until around half the expected life. The onset of cavitation was shown to be associated with the attainment of a stable grain boundary configuration with boundaries aligned at about 45 deg to the stress axis. Author

N72-25513 Waterloo Univ. (Ontario). Solid Mechanics Div.
THE INFLUENCE OF GRAIN SIZE AND DISPERSION ON THE CREEP DUCTILITY OF COPPER BASE ALLOYS
R. G. Fleck and D. M. R. Taplin Oct. 1971 39 p refs Presented at Fall AIME Conf., Detroit, 18 Oct. 1971
(TN-12) Avail: Issuing Activity

Results of a study of the creep behavior of a commercial copper base alloy (95.0% Cu - 2.89% A1 - 1.89% Si - 0.4% Co) are discussed. Testing was carried out at a nominal constant strain rate of 0.07/hr at 400, 600 and 700 C. Constant load tests giving initial stresses of 127.2 MN/sq m and 26.8 MN/sq m were carried out at 400 and 600 C respectively. In these tests both grain size and precipitate distribution were varied and results of percent elongation, flow stress (1% offset) and minimum creep rate were obtained. Failure in each case was by intergranular cavitation. Measurements of grain boundary sliding and fractional density change were used to measure the extent of cavitation under the different test conditions. The results are interpreted by considering that a critical crack length criterion is important at coarse grain sizes, and interlinkage mechanisms and size of cavities are important at fine grain sizes. Author

N72-25514 Waterloo Univ. (Ontario). Solid Mechanics Div.
A METALLOGRAPHIC STUDY OF SUPERPLASTICITY IN A MICROGRAIN ALUMINUM BRONZE
G. L. Dunlop and D. M. R. Taplin Sep. 1971 26 p refs Presented at Conf. on Met., Liverpool, 28 Sep. 1971 Sponsored by Natl. Res. Council of Can. and Def. Res. Board of Can.
(Rept-93) Avail: Issuing Activity

Metallographic studies, after deformation over a range of strain rates at 800 C encompassing the three stage strain rate hardening behavior common to superplastic materials are presented. Data show that in the low strain rate range, below that for high values of the strain rate sensitivity exponent (m), clumps of grains slide together as units with considerable flow in the matrix close to sliding interfaces. After deformation in this low strain rate range there is no evidence for dislocation motion within the grains. With increasing strain rate, through and beyond the strain rate range where peak values of m are recorded, evidence for dislocation motion steadily increases; the tendency for clumps of grain to slide together diminishes; and there is little flow in the matrix about the sliding interfaces. The strain rate for maximum m shows a strong dependence on the proportion of beta phase in the microstructure and the presence of iron which acts to refine the grain size. These observations are explained in terms of a flow mechanism whereby the high strain rate sensitivity range occurs intermediate between a slow range, where sliding is accommodated by diffusion, and a fast range, where accommodation is by dislocation movement through the matrix. Author

N72-25515 Waterloo Univ. (Ontario). Solid Mechanics Div.
SUPERPLASTICITY AND CAVITATION IN ALPHA-BETA BRASS
S. Sagat, P. Blenkinsop (Imperial Metal Ind., Ltd., Birmingham, Engl.), and D. M. R. Taplin Sep. 1971 22 p refs Submitted for publication Sponsored by Natl. Res. Council of Can. and Def. Res. Board of Can.
(Rept-92) Avail: Issuing Activity

A study was made of the deformation and fracture of fine-grained alpha-beta brass (Cu-40% Zn) between 400 and 700 C, at strain rates between -0.03 and 0.00003/sec for grain (phase) sizes of 3 and 30 microns average diameter. A maximum neck-free elongation of greater than 500% was obtained at 600 C at a strain rate of -0.00053/sec for a grain size of 3 microns. Intergranular and interphase cavitation was observed particularly at high strain rates. Grain boundary sliding and migration were observed, and electron microscopy indicated that the defect structure of the grains remained low during superplastic deformation. It was deduced that for commercial application further alloy development is required in view of the grain coarsening and high level of cavitation. The mechanism of flow in the superplastic range is deduced to be controlled by grain boundary sliding. Author

N72-25516*# Translation Consultants, Ltd., Arlington, Va.
THE EFFECT OF AUSTENITE STRUCTURE FLAWS ON CARBON DIFFUSION
I. N. Kudin, V. I. Andryushechkin, and V. A. Volkov Washington NASA May 1972 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 11, 1969 p 132-135
(Contract NASw-2038)
(NASA-TT-F-14272) Avail: NTIS HC $3.00 CSCL 11F

An increase in the overall extent of the grain boundaries accelerates carbon diffusion, while an increase in the number of intragrain flaws decelerates the carbon diffusion process. The latter increase is much more important than the former. Author

N72-25517*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALUMINIZED NICKEL COATINGS FOR NICKEL-BASE SUPERALLOYS Patent Application
James L. Smialek and Salvatore J. Grisaffe, inventors (to NASA) Filed 25 Apr. 1972 8 p
(NASA-Case-LEW-11348-1; US-Patent-Appl-SN-247482) Avail: NTIS HC $3.00 CSCL 11D

A nickel-rich layer is deposited and sintered to a nickel-base superalloy substrate before aluminizing. This assures the formation of the intermetallic compound NiAl almost exclusively. The aluminide is formed by conversion of this nickel-rich layer only. NASA

N72-25518# Bureau of Mines, Washington, D.C.
CREEP AND OTHER PROPERTIES OF EXTRUDED ZINC-30 PERCENT ALUMINUM ALLOYS CONTAINING MAGNESIUM
L. A. Neumeier and J. S. Risbeck Jul. 1971 32 p refs
(BM-RI-7538) Avail: NTIS HC $3.75

Creep and other properties of extruded Zn-30% Al alloys containing 0 to 0.7% Mg were evaluated. The alloys were extruded both above and below the Zn-Al eutectoid temperature of 275 C. Creep behavior is defined for the alloys as extruded and after various heat treatments. Tensile properties, hardness, thermal expansivity, impact resistance, and microstructures are given. The alloys, either with or without magnesium, required substantially less pressure for extrusion near 275 C than at higher or lower temperatures. The alloys containing magnesium exhibited significantly greater hardness, tensile strength, and creep resistance, but much lower ductility than the Zn-30% Al alloy. The properties were sensitive to the processing conditions. Author

N72-25519# Bureau of Mines, Minneapolis, Minn.
KINETICS OF THERMAL DECOMPOSITION OF COPPER(II) SULFATE AND COPPER(II) OXYSULFATE
I. D. Shah and S. E. Khalafalla 1972 25 p refs
(BM-RI-7638) Avail: NTIS HC $3.25

Nonisothermal thermogravimetric techniques were used to investigate the decomposition reactions in flowing N2 and air. Thermal decomposition of CuSO4 and CuO(CuSO4) followed linear kinetics with an apparent activation energy of 55 + or - 2 and 66 + or - 3 kcal per mole decomposed, respectively. These apparent activation energies comply with those previously reported when isothermal kinetic techniques were used. The addition of oxygen decreased the rate of decomposition, while small amounts of iron, which were mixed with CuO(CuSO4) did not have a significant effect. Neither oxygen nor iron had any appreciable effect on the apparent activation energy of the decomposition reaction. Author

N72-25520# Bureau of Mines, College Park, Md.
IDENTIFICATION AND ANALYSES OF COPPER-BASE ALLOYS BY FLUORESCENT X-RAY SPECTROGRAPHY
William J. Campbell and Harold E. Marr, III 1972 35 p refs
(BM-RI-7635) Avail: NTIS HC $3.75

Three types of X-ray analytical instrumentation were compared for applications in the secondary brass and bronze industry. The instruments were a conventional X-ray spectrograph, a portable X-ray spectrograph, and a radioisotopic X-ray analyzer using balanced filters. The following two general applications were considered: rapid identification for sorting scrap metals, and quantitative analyses to provide guidance in the melting and casting of alloys. Twenty-three analyzed copper-base alloys were used as standards. Although the alloys varied widely in composition, matrix correction procedures were not necessary except for copper. The conventional X-ray spectrograph provides positive identification of the alloys and quantitative values for the six elements investigated--aluminum, copper, iron, lead, tin, and zinc. Equivalent results were obtained with the portable X-ray spectrograph for those elements whose characteristic X-rays are in the wavelength range of the instrument. The radioisotopic X-ray analyzer distinguishes certain groups of alloys and provides quantitative determinations for copper, lead, tin, and zinc. The sensitivity of the analyzer was marginal for the determination of small concentrations of elements of atomic number 26 or lower. Author

N72-25521*# Translation Consultants, Ltd., Arlington, Va.
THE DISLOCATION STRUCTURE OF ALTERNATELY STRESSED AUSTENITIC STEELS
B. Weiss Washington NASA May 1972 11 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Duesseldorf), v. 41, no. 2, Feb. 1970 p 155-158
(Contract NASw-2038)
(NASA-TT-F-14267) Avail: NTIS HC $3.00 CSCL 11F

The use of electron microscopy to analyze the dislocation structure of two alternately stressed austenitic steels is discussed. The material was stressed under the fatigue and cyclic stress range. Electron-optical photographs of dislocation characteristics are given along with results from a comparison with a model conception. Author

N72-25522*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INVESTIGATION OF GOLD EMBRITTLEMENT IN CONNECTOR SOLDER JOINTS
Frank L. Lane 1 Apr. 1972 15 p refs
(Contract NAS7-100)
(JPL-TM-33-533; NASA-CR-126972) Avail: NTIS HC $3.00 CSCL 11F

An investigation was performed to determine to what extent typical flight connector solder joints may be embrittled by the presence of gold. In addition to mapping of gold content in connector solder joints by an electron microprobe analyzer, metallographic examinations and mechanical tests (thermal shock, vibration, impact and tensile strength) were also conducted. A description of the specimens and tests, a discussion of the data, and some conclusions are presented. Author

N72-25523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MECHANICAL PROPERTIES OF ELECTRON-BEAM-MELTED MOLYBDENUM AND DILUTE MOLYBDENUM-RHENIUM ALLOYS
William D. Klopp and Walter R. Witzke Washington Jun. 1972 21 p refs
(NASA-TM-X-2576; E-6753) Avail: NTIS HC $3.00 CSCL 11D

A study of molybdenum and three dilute molybdenum-rhenium alloys was undertaken to determine the effects of rhenium on the low temperature ductility and other mechanical properties of molybdenum. Alloys containing 3.9, 5.9, and 7.7 atomic percent rhenium exhibited lower ductile-brittle transition temperatures than did the unalloyed molybdenum. The maximum improvement in the annealed condition was observed for molybdenum - 7.7 rhenium, which had a ductile-brittle transition temperature approximately 200 C (360 F) lower than that for unalloyed molybdenum. Rhenium additions also increased the low and high temperature tensile strengths and the high temperature creep strength of molybdenum. The mechanical behavior of dilute molybdenum-rhenium alloys is similar to that observed for dilute tungsten-rhenium alloys. Author

N72-25524*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMOMECHANICAL AND THERMOCHEMICAL BEHAVIOR OF A HAFNIUM-20 PERCENT TANTALUM ALLOY Ph.D. Thesis - North Carolina State Univ., Raleigh
James Preston Howell 1971 171 p refs
(NASA-TM-X-68339) Avail: NTIS HC $10.75 CSCL 11D

An investigation was conducted to determine the thermomechanical and thermochemical behavior of a high temperature, oxidation resistant, hafnium-20 percent tantalum alloy. The elastic and shear moduli of this alloy were determined in air up to 1000 C and in vacuum up to 2000 C using a mechanical resonance technique. The internal friction of the alloy was measured up to temperatures greater than 1400 C. Room temperature stress-strain behavior of the oxidized and unoxidized alloy was established. The effect of annealing on the elastic and shear moduli of the extruded rod material was investigated. The martensitic-type phase transformation occurring in the alloy was studied using hot stage metallography and electron microscopy. Static oxidation tests were conducted on the alloy at temperatures from 1000 C to 1700 C with weight gain measurements made as a function of time and temperatures. Surface morphology studies were conducted on the oxide coatings formed at the different temperatures using scanning electron microscopy and X-ray diffraction techniques. Author

N72-25525# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF AGE-HARDENING PROCESSES ON THE BEHAVIOUR OF STRESS-STRAIN CURVES
G. Pysz Mar. 1971 28 p refs Transl. into ENGLISH from Freiberger Forschungsh. (Berlin), B123, 1967 p 95-113
(RAE-Lib-Trans-1525; BR25396) Avail: NTIS HC $3.50

It is shown that the characteristics values of the flow curve, the constant a, and particularly the hardening n, are more sensitive to individual hardening or precipitation states than are other mechanical characteristics values, and hence provide a better insight into the hardening process. Author

N72-25526# Technische Universitaet, Brunswick (West Germany).
EXPERIMENTAL-NUMERICAL DETERMINATION OF RESIDUAL STRESSES IN AUSTENITE PLATED STEEL SHEETS Ph.D. Thesis [EXPERIMENTELL-RECHNERISCHE

BESTIMMUNG VON EIGENSPANNUNGEN IN AUSTENIT-PLATTIERTEN STAHLBLECHEN]
Heinrich Schimmoeller 1971 102 p refs In GERMAN
Avail: NTIS HC $7.25

Macroscopic residual stresses in sheet metal with austenitic chromium nickel steel lamination are studied. Considered are stress corrosion effects of production methods such as warm rolling and explosive welding as well as of annealing and straining. Results show that residual shear stress values are somewhat smaller than normal stress values and that a level hydrostatic residual stress condition is found in a large part of the sheet's thickness. The largest pressure and strain eigenvalues are observed in the austenite layer, the former at the surface and the latter in the welding interface. Transl. by G.G.

N72-25527# Joint Publications Research Service, Arlington, Va.
COLD RESISTANCE OF STEEL AND STEEL STRUCTURES
23 May 1972 51 p refs Transl. into ENGLISH from the publ. "Khladostoykost' Stali i Stal'nykh Konstruktsiv" Novosibirsk, Nauka, 6 Aug. 1970 p 134-144, 179-184, and 205-231
(JPRS-56070) Avail: NTIS HC $4.75

Various aspects of cold resistance of steels and steel structures are reviewed, including brittle fracture of steel welded joints; effect of chromium, manganese, and heat treatment on brittleness; cracks in sheet structural materials; and brittleness of low alloy steels. For individual titles, see N72-25528 through N72-25531.

N72-25528# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF THE TENDENCY TO BRITTLE FRACTURE OF WELD JOINTS OF MEDIUM-ALLOY STEELS PREPARED BY THE ELECTRO-SLAG PROCESS
G. V. Nazarov *In its* Cold Resistance of Steel and Steel Struct. 23 May 1972 p 1-11 refs (See N72-25527 16-17)
Avail: NTIS HC $4.75

The characteristics of brittle fracture analysis of medium alloy steels are discussed in relation to electroslag welding of ship components. Thermal cycling tests were conducted on the seam metal IMET-1, and the results are presented. K.P.D.

N72-25529# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF CHROMIUM, MANGANESE, AND CONDITIONS OF HEAT TREATMENT ON THE COLD-SHORTNESS OF TYPE 30kh2GN2 STEEL
Yu. N. Maslova, V. A. Bocharev, and T. A. Korostovtseva *In its* Cold Resistance of Steel and Steel Struct. 23 May 1972 p 12-18 (See N72-25527 16-17)
Avail: NTIS HC $4.75

A study on brittleness was done on medium alloy cast steel of type 30Kh2GN2 by determining the magnitude of the impact strength on Menage-type test bars 10 x 10 X 55 mm in size at test temperatures of +20, -20, -40, and -60 C and energy of static bending on samples 10 X 10 X 55 mm in size with an angular notch (angle of opening, 60 depth of notch 2 mm, r = 0.2 mm) at test temperatures of -20, -40, -60, and -80 C. The steel was smelted in a 75-ton basic open hearth furnace. The specific energy of deformation during static bending was determined by the method of planimetry of the areas of the diagrams obtained by testing samples on a 12-ton machine. By analyzing the test results of static bending, the magnitude of the specific energy of the individual segments of the bending diagram and the presence of a crystalline component in the fractures of the test bars were determined. Author

N72-25530# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF CRACKS ON THE STRENGTH OF HIGH-STRENGTH SHEET STRUCTURAL MATERIALS c32
S. Ye. Belyayev *In its* Cold Resistance of Steel and Steel Struct. 23 May 1972 p 19-31 refs (See N72-25527 16-17)
Avail: NTIS HC $4.75

The influence of a crack and a notch on the tensile strength of a flat test bar was studied. A crack in sheet material was produced by static tension with eccentricity of the flat test bar with a two-sided notch. It is shown that the sensitivity to cracking is associated with both strength and the structure of the metal. In addition, the influence of cracks on the strength and plasticity of several aluminum alloys was investigated. It is shown that the tensile strength of high strength sheet steels and alloys depends on the length of the crack and the test temperature. K.P.D.

N72-25531# Joint Publications Research Service, Arlington, Va.
TENDENCY OF LOW-ALLOY STEELS TO COLD-SHORTNESS FOR METALLIC STRUCTURES
V. A. Baldin, R. G. Arone, and P. I. Sokolovskiy *In its* Cold Resistance of Steel and Steel Struct. 23 May 1972 p 32-48 refs (See N72-25527 16-17)
Avail: NTIS HC $4.75

Various methods of evaluating the tendency toward brittleness in steels are considered. It is concluded that it is necessary to develop standard methods and standard samples of steels which are characteristic of groups of structures or for determined conditions of operation of steel in elements and components of metal structures. K.P.D.

N72-25532# Grumman Aerospace Corp., Bethpage, N.Y.
SOLIDIFICATION OF MOLTEN METAL SPHERES IN VACUUM
J. Reichman Jun. 1972 14 p refs
(RM-544) Avail: NTIS HC $3.00

Drop tower experiments proposed to study the solidification of metal drops permit only about three seconds of free fall. Selection of materials is dictated by the time to solidify, which is primarily determined by the two modes of heat removal in a vacuum: radiation and evaporation. Equations are derived to determine the time to solidify for these two modes. The following metals were found to solidify in relatively short time periods: Ca, Mg, Sr, Cr, W, and Ta. Author

N72-25533# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
FABRICATION AND STUDY OF OSMOTIC METALLIC MEMBRANES Ph.D. Thesis - Grenoble Univ.
Richard Deschamps Dec. 1971 92 p refs In FRENCH
(CEA-R-4129) Avail: AEC Depository Libraries

The use of osmotic membranes for the desalinization of sea water is discussed. The principles and thermodynamics of osmosis are considered, and the fabrication of various mineral membranes is reviewed. The semipermeable properties of membranes, hyperfiltration, and filtration mechanisms are also discussed. Transl. by K.P.D.

N72-25534# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
INVESTIGATIONS OF THE CORROSION BEHAVIOR OF AUSTENITIC CrNi STEELS AND NICKEL ALLOYS IN SUPERHEATED STEAM
S. Leistikow [1972] 32 p refs Transl. into ENGLISH of West German report KFK-1463 Sponsored by AEC-EURATOM Fast Neutron Reactor Exchange
(EURFNR-954; KFK-1463) Avail: NTIS

The results of studies on the corrosion behavior of chromium-nickel steels and nickel-base alloys in superheated steam show that they are very much influenced by previous treatment of the metal and the operating conditions. The factors considered, such as oxygen content in the superheated steam, degree of cold working, and grain size of the material, were all evidence of this. Austenitic Cr-Ni steels exhibited a variable resistance of superheated steam corrosion. The nickel-base alloys (Incoloy 800, Inconel 625, Inconel 718, Inconel 600, and Hastelloy 255) exhibited extremely good corrosion resistance. It was concluded that in choosing a suitable material for steam superheaters at surface temperatures between 600 and 700 C, it appears desirable under both conventional and nuclear conditions

to use a coldworked Cr-Ni steel with 20% Cr and 20 to 30% Ni. NSA

N72-25535# Mound Lab., Miamisburg, Ohio.
COMPATIBILITY OF (Pu-238)O2 WITH VARIOUS NICKEL AND COBALT BASE ALLOYS
D. R. Schaeffer 10 Jan. 1972 203 p refs
(Contract AT(33-1)-Gen-53)
(MLM-1864) Avail: NTIS

Results from a compatibility study between production grade (Pu-238)O2 with various nickel- and cobalt-base alloys are presented and discussed. The alloys studies were Hastelloy N, Hastelloy X, Haynes 25, Haynes 188, Inconel 625, and TD nickel. Test temperatures were 800 and 1000 C with thermal exposures up to 360 days. Suggested interpretation of the data and resultant mechanisms are given. Author (NSA)

N72-25536# Battelle Memorial Inst., Columbus, Ohio. Metals and Ceramics Information Center.
SYMPOSIUM ON ELECTRODEPOSITED METALS AS MATERIALS FOR SELECTED APPLICATIONS
Jan. 1972 132 p refs Conf. Held at Columbus, Ohio, 3-4 Nov. 1971 Sponsored by Defense Supply Agency
(AD-738272; MCIC-72-05) Avail: NTIS CSCL 11/6

Contents: Introductory data on properties and applications; The physical properties of the precious metals; Properties of electrodeposited foils for use in printed circuits; Precious metal electrodeposits for electrical contact applications; Properties of electroless cobalt and recording technology; Strength and ductility of electroformed nickel; Nickel electroforming applications--why they exist; Properties of electroplated automotive bumpers; Some mechanical properties of electrodeposited lead and lead alloys; Maintaining structural integrity of aerospace components; Electroplate property specifications for metal fasteners; Joining aluminum to stainless steel by electroplating. GRA

N72-25537# Army Materials and Mechanics Research Center, Watertown, Mass. Materials Sciences Div.
RELATION BETWEEN THE EROSION BY SOLID PARTICLES AND THE PHYSICAL PROPERTIES OF METALS
Paolo Ascarelli Nov. 1971 24 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-738162; AMMRC-TR-71-47) Avail: NTIS CSCL 11/6

The work is an attempt to identify and select those physical properties of materials that can be closely correlated with their resistance to erosion due to solid particle impingement. A simple erosion mechanism which employs the concept of thermal pressure has been used to obtain a very good correlation with available data on erosion of pure metals and their bulk thermal and elastic properties. The erosion resistance of metals at elevated temperatures appears to be sensitive to the temperature dependence of their properties under plastic deformation. A treatment is given in terms of the malleability, that is, the product of shear modulus and isothermal compressibility. The dependence of erosion on the velocity of the impinging particle is also discussed, and it is suggested that strain rate effects in plastic deformation may be contributing to the nonlinear dependence upon kinetic energy. Author (GRA)

N72-25538# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
DYNAMIC INELASTIC BEHAVIOR OF MATERIALS Final Scientific Report, 1 Jun. 1969 - 30 Nov. 1971
Sol R. Bodner Dec. 1971 16 p
(Contract F61052-69-C-0042; AF Proj. 9782)
(AD-738326; MED-34; AFOSR-72-0562TR) Avail: NTIS CSCL 11/6

The principal subjects investigated were the effects of dynamic, cyclic, and incremental loading on the time dependent response of materials; the repeated discontinuous yielding of metals; formulation and solution of elastic-viscoplastic boundary value problems using an approach analogous to 'dislocation dynamics'; and the mechanics of ballistic penetration. The accomplishments of the program are discussed and the proposed directions of future research are indicated. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-25539* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF MAKING FIBER COMPOSITES Patent
Donald W. Petrasek, Robert A. Signorelli, John W. Weeton, and Gerald B. Beremand, inventors (to NASA) Issued 4 Apr. 1972 5 p Filed 27 Feb. 1970 Continuation-in-part of US Patent Appl. SN-768907, filed 18 Oct. 1968
(NASA-Case-LEW-10424-2-2; US-Patent-3,653,882; US-Patent-Appl-SN-15222; US-Patent-Class-75-208; US-Patent-Class-75-211; US-Patent-Class-75-226; US-Patent-Class-75-DIG.1) Avail: US Patent Office CSCL 11D

A method is described for making a fiber composite having high strength at 2000 to 2200 F. A nickel alloy matrix slurry was poured into an array of tungsten fibers. The slip is dried and sintered in dry hydrogen at 1500 F for one hour. The resulting composite is isostatically hot pressed at 20,000 psi at 1500 F for one hour, and followed by a second isostatic hot pressing at 2000 F for one hour. Official Gazette of the U.S. Patent Office

N72-25540* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HONEYCOMB PANELS FORMED OF MINIMAL SURFACE PERIODIC TUBULE LAYERS Patent
Alan H. Schoen, inventor (to NASA) Issued 16 May 1972 7 p Filed 16 Jul. 1970 Supersedes N70-40061 (08-22, p 4146)
(NASA-Case-ERC-10364; US-Patent-3,663,347; US-Patent-Appl-SN-55537; US-Patent-Class-161-68; US-Patent-Class-52-80; US-Patent-Class-52-DIG.10; US-Patent-Class-161-7; US-Patent-Class-161-127) Avail: US Patent Office CSCL 13M

Panels including honeycomb cores formed of minimal surface periodic tubule layers are described. Each tubule layer is defined as being formed of minimal surface elements that orthogonally intersect all of the faces of a kaleidoscopic cell at least once. The tubule layers are broken into elemental sections and the elemental sections are defined as minimal surface elements, i.e., elements having a mean curvature at all points on the surface that is equal to zero. These elements are further defined inside kaleidoscopic cells, wherein they orthogonally intersect all faces of the kaleidoscopic cell with which they are associated at least once. The minimal surface elements are smoothly interconnected to form tubule layers which are stacked in a reflection image-like manner to form a honeycomb core having no internal discontinuities.
Official Gazette of the U.S. Patent Office

N72-25541* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HONEYCOMB CORE STRUCTURES OF MINIMAL SURFACE TUBULE SECTIONS Patent
Alan H. Schoen, inventor (to NASA) Issued 16 May 1972 15 p Filed 22 Jul. 1970 Supersedes N70-40071 (08 - 22, p 4146)
(NASA-Case-ERC-10363; US-Patent-3,663,346; US-Patent-Appl-SN-57253; US-Patent-Class-161-68; US-Patent-Class-52-80; US-Patent-Class-52-DIG.10; US-Patent-Class-161-7; US-Patent-Class-161-127) Avail: US Patent Office CSCL 13M

Honeycomb cores formed of tubule sections bounded orthogonally by plane facings are described. The tubule sections are defined as being formed of minimal surface elements that orthogonally intersect all of the surfaces of an imaginary kaleidoscopic cell at least once. The tubule sections are broken into elements for definition purposes. The elements are defined as minimal surface elements, i.e., elements that have a mean curvature that is equal to zero at all points on their surface. These elements are further defined inside of an imaginary kaleidoscopic cell in that they orthogonally intersect all surfaces of an imagery kaleidoscopic cell at least once. The tubule sections are smoothly interconnected to form honeycomb core structures that have no internal discontinuities.
Official Gazette of the U.S. Patent Office

N72-25542*# North American Rockwell Corp., Downey, Calif. Space Div.
THERMAL DESIGN OF COMPOSITE MATERIALS HIGH TEMPERATURE ATTACHMENTS Final Report
May 1972 135 p refs
(Contract NAS8-27041)
(SD-72-SH-0015; NASA-CR-123572) Avail: NTIS HC $8.75 CSCL 11D

The thermal aspects of using filamentary composite materials as primary airframe structures on advanced atmospheric entry spacecraft such as the space shuttle vehicle were investigated to identify and evaluate potential design approaches for maintaining composite structures within allowable temperature limits at thermal protection system (TPS) attachments and/or penetrations. The investigation included: (1) definition of thermophysical data for composite material structures; (2) parametric characterization and identification of the influence of the aerodynamic heating and attachment design parameters on composite material temperatures; (3) conceptual design, evaluation, and detailed thermal analyses of temperature limiting design concepts; and (4) the development of experimental data for assessment of the thermal design methodologies and data used for evaluation of the temperature-limiting design concepts. Temperature suppression attachment concepts were examined for relative merit. The simple isolator was identified as the most weight-effective concept and was selected for detail design, thermal analysis, and testing. Tests were performed on TPS standoff attachments to boron/aluminum, boron/polyimide and graphite/epoxy composite structures. Author

N72-25543*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPLORATION OF ALLOY SURFACE AND SLURRY MODIFICATION TO IMPROVE OXIDATION LIFE OF FUSED SILICIDE COATED NIOBIUM ALLOYS
S. R. Levine and S. J. Grisaffe 1972 37 p refs Presented at the Refractory Metal Coatings Session of the Met. Soc.-Am. Inst. of Mining, Met., and Petrol. Engr. Meeting, Boston, 8-11 May 1972
(NASA-TM-X-68052; E-6751) Avail: NTIS HC $4.00 CSCL 11D

Edge and surface modifications of niobium alloys were investigated prior to coating with Si-20Cr-20Fe and slurry composition modification for performance in a 1370 C ambient pressure slow cycle test. The best coating obtained was Si-20Cr-20Mn with an average life of 63 cycles, compared to 40 for Si-20Cr-20Fe on FS-85 (100 percent improvement in weight parity life). Edge beading extended the lives of Si-20Cr-20Fe-coated Cb-752 and FS-85 to 57 and 41 cycles respectively (50 and 20 percent improvements in weight parity life respectively). W, Al2O3 and ZrO2(CaO) surface modifications altered coating crack frequency and microstructure and increased life somewhat. Author

N72-25544*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF TEMPERATURE ON THE TENSILE AND CREEP CHARACTERISTICS OF PRD49 FIBER/EPOXY COMPOSITES
M. P. Hanson 1972 9 p refs Presented at the 6th Symp. on Composite Mater. in Eng. Design, St. Louis, 11-12 May 1972
(NASA-TM-X-68053; E-6903) Avail: NTIS HC $3.00 CSCL 11D

Tensile and creep data of PRD49-1 and -3 fiber/epoxy resin composites are presented. Tensile data were obtained from 20 K (-423 F) to 477 K (400 F). Tensile strengths and moduli were determined at selected temperatures. Creep data up to 1000 hours are presented of fiber composites at 279 K (75 F), 422 K (300 F), and 450 K (350 F) at stress levels of approximately 50 and 80 percent of the ultimate tensile strength at 297 K (75 F). Details are presented of tensile specimens and test procedures used in the investigation. Author

N72-25545*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOME OBSERVATIONS ON URANIUM CARBIDE ALLOY/TUNGSTEN COMPATIBILITY
W. M. Phillips 15 May 1972 20 p refs
(Contract NAS7-100)
(NASA-CR-126869; JPL-TM-33-547) Avail: NTIS HC $3.00 CSCL 11D

Chemical compatibility between both pure and thoriated tungsten and uranium carbide alloys was studied at 1800 C for up to 3300 hours. Alloying with zirconium carbide appeared to widen the homogeneity range of uranium carbide, making additional carbon available for reaction with the tungsten. Reaction layers were formed both by vapor phase reaction and by physical contact, producing either or both UWC2 and W2C, dependent upon the phases present in the starting fuel alloy. Formation of UWC2 results in slow growth of the reaction layer with time, while W2C reaction layers grow rapidly, allowing equilibrium to be reached in less than 2500 hours at 1800 C. The presence of a thermal gradient had no effect on the reactions observed nor did the presence of thoria in the tungsten clad. Author

N72-25546*# Schjeldahl (G. T.) Co., Northfield, Minn. Advanced Programs Div.
COMPARISON OF POLYESTER, FILM-YARN COMPOSITE, BALLOON MATERIALS SUBJECTED TO SHEAR AND BIAXIAL LOADING
R. J. Niccum Washington NASA Jun. 1972 53 p
(Contract NAS1-10750)
(NASA-CR-2047) Avail: NTIS HC $3.00 CSCL 11D

A series of candidate materials for use in large balloons was tested and their tensile and shear strength capabilities were compared. The tests were done in a cold box at -68 C (-90 F). Some of these materials were fabricated on a special machine called the flying thread loom. This machine laminates various patterns of polyester yarn to a thin polyester film. The results show that the shear strength of materials changes with the angle selected for the transverse yarns, and substantial increases in biaxial load carrying capabilities, compared to materials formerly used, are possible. The loom capabilities and the test methods are discussed. Author

N72-25547*# Advanced Rocket Technology, Irvine, Calif.
EVALUATION OF ZIRCONIA, THORIA AND ZIRCONIUM DIBORIDE FOR ADVANCED RESISTOJET USE
Russell J. Page, Robert A. Short, and Carl R. Halbach May 1972 133 p refs
(Contract NAS1-10353)
(NASA-CR-112075) Avail: NTIS HC $8.75 CSCL 11D

A literature survey was conducted to collect material properties data on all advanced high temperature materials. Three of these, Y2O3-stabilized ZrO2, ThO2, and ZrB2 with additives of C and SiC were selected for further study. Stabilized ZrO2 and ThO2 were found to have higher temperature oxidation resistance than any metal and great potential for use in advanced biowaste resistojets. ZrO2 has a lower electrical resistivity and sublimation and a higher creep endurance strength.

ZrO2 and ThO2 tubular heat exchangers, electrically heated indirectly, were evaluated in short tests to about 1900 K in flowing CO2. ZrO2 was subjected to N2, H2, H2O and vacuum as well. X-ray diffraction and fluorescence analyses were made. The metal-to-ceramic seal technology for ZrO2 and ThO2 was developed using chemical vapor deposition of tantalum for metallizing and 82 Au - 18 Ni filler braze. Author

N72-25548*# Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry.
TORSION PENDULUM MEASUREMENTS ON VISCOELASTIC MATERIALS DURING VACUUM EXPOSURE
Thomas C. Ward and Morris L. Evans Washington NASA Jun. 1972 70 p refs
(Contract NAS1-10043)
(NASA-CR-2074) Avail: NTIS HC $3.00 CSCL 11D

A torsional pendulum apparatus designed for testing in situ in vacuum, the dynamic mechanical properties of materials is described. The application of this apparatus to an experimental program to measure the effects of vacuum on the mechanical properties of two ablator materials (a foamed material and a filled elastomer) and a solid rocket propellant (a filled elastomer) is presented. Results from the program are discussed as to the effects of vacuum on the mechanical properties of these three materials. In addition, time-temperature-superposition, as a technique for accelerating vacuum induced changes in mechanical properties, is discussed with reference to the three materials tested in the subject program. Author

N72-25549# Defence Standards Labs., Maribyrnong (Australia).
COATED TIMBER FOR UNDERWATER APPLICATIONS
P. Dunn and G. F. Sansom Mar. 1972 55 p refs
(Rept-498) Avail: NTIS HC $4.75

The protection of timber (West African mahogany, Khaya ivorensis) when used in the underwater environment was investigated. Trials were undertaken in the sea off Clump Point, North Queensland, to determine the resistance of timber coated with reinforced and unreinforced organic materials, to attack by shipworms. Eleven coating systems, all of potential practical value, were evaluated. Some organotin toxicants were incorporated into some timber and coatings in order to assess their effects, if any, on marine growths and organisms. A nondestructive radiographic technique was used to examine exposed panels for evidence of attack by shipworms. The ability of barnacles to record characteristic imprints on a specific type of coating, was also observed. Of the coatings examined, four materials showed excellent performance, following marine immersion for periods of up to thirty-six months. Author

N72-25550# Defence Standards Labs., Maribyrnong (Australia).
UNDERWATER MARINE COATINGS. PART 2: MARINE BIOCIDAL RUBBERS CONTAINING ORGANOTIN TOXICS
J. M. D. Woodford Mar. 1972 40 p refs
(Rept-496) Avail: NTIS HC $4.00

A preliminary investigation of the marine biocidal properties of a series of formulations based on three different elastomers containing three readily available tri-n-butyltin compounds was completed using both molded sheets and solution coatings. The results of sea water exposure trials indicate that effective long life coatings could be developed from some of these systems. Author

N72-25551*# Commonwealth Scientific Corp., Alexandria, Va.
THE DEVELOPMENT OF MATERIALS CAPABLE OF OPERATION IN AN OXIDIZING ATMOSPHERE FOR EXTENDED PERIODS OF TIME Final Report, Feb. 1971 - May 1972
A. P. Duhamel May 1972 6 p
(Contract NAS5-21390)
(NASA-CR-122425) Avail: NTIS HC $3.00 CSCL 11D

An evaluation is presented of silicon carbide, zirconium diboride, and iridium-coated graphite as materials for construction of furnace cores which could operate under highly oxidizing conditions at temperatures of approximately 2,200 C in the presence of molten aluminum oxide. It was found that silicon carbide and zirconium diboride could not withstand oxidizing atmospheres in the presence of aluminum oxide at temperature 2,200 C. However, graphite furnace cores coated with iridium were found to be useful furnace cores at 2,200 C in an oxidizing atmosphere for reasonably extended periods of time. Author

N72-25552# Toulouse Univ. (France). Lab. de Genie Electrique.
DEGRADATION OF POLYMERS USED AS INSULATORS IN ELECTRICAL MATERIALS DUE TO DISCHARGES [DEGRADATION, DUE AUX DECHARGES, DES POLYMERES UTILISES COMME ISOLANTS DANS LE MATERIEL ELECTRIQUE]
R. Lacoste [1971] 21 p refs In FRENCH
Avail: NTIS HC $3.25

A test unit was designed to analyze causes and effects of local electric discharges in a high voltage electric field due to occlusion or defects in polymer insulating materials. Infrared spectroscopy was used to analyze damage caused by heating, excitation, ionization, and electron bombardment. It is shown that ionization is the process which causes the most damage. Polyesters and epoxy resins are listed according to their resistance to local electric discharge damage. ESRO

N72-25553# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
DEGRADATION KINETICS OF MAGNESIUM FLUORIDE [CINETIQUE DE DEGRADATION DU FLUORURE DE MAGNESIUM]
M. Romero Feb. 1972 108 p refs In FRENCH
(ONERA-DERTS-NT-02-29) Avail: NTIS HC $7.50

Samples of magnesium fluoride were submitted to electron irradiation. Crystal defects generated were analyzed and the kinetics of degradation were discussed. An analytical expression of the density of color centers is derived for different models and the physical meaning of the parameters is discussed. A comparison with experimental results is presented. ESRO

N72-25554# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.
BIBLIOGRAPHICAL SURVEY ON FLEXIBLE PLASTIC SOLAR REFLECTORS (SSM): FABRICATION, OPTICAL PROPERTIES, AGING [DONNEES BIBLIOGRAPHIQUES CONCERNANT LES REFLECTEURS SOLAIRES SOUPLES PLASTIQUES (SSM): FABRICATION, PROPRIETES OPTIQUES, VIEILLISSEMENT]
A. Paillous Mar. 1972 34 p refs In FRENCH
(ONERA-DERTS-NT-03-8) Avail: NTIS HC $3.75

A bibliographic survey is presented on the properties of materials and fabrication methods of series-emittance thermal control coatings. Materials such as polycarbonate, silicones, vinyl fluorides, polyethylene, Teflon, polyimides, and polyethylene terephtalates are included in the survey. Initial thermo-optical properties and resistance to ground ultraviolet radiation, ground ionizing radiation, and combined radiation in flight are analyzed. The use of adhesives is also discussed. ESRO

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-25555 Pennsylvania Univ., Philadelphia.
MINIMAX SOLUTION OF SECOND ORDER PHASE LOCK LOOP ACQUISITION TIME Ph.D. Thesis

Stephen L. Goldman 1971 321 p
Avail: Univ. Microfilms Order No. 71-26017

The results of computer simulations of phase lock acquisition at 10 different S/N ratios at the phase lock loop output are reported. The range of S/N ratio that minimizes the maximum acquisition time for sample initial conditions at a conditionally stable equilibrium point and near a saddle point separatrix was determined. The simulation results were extended to power-limited systems, such as a satellite communications link using time division multiple access. A design example is presented showing the relationship between acquisition time, mean time to first loss of phase lock, TDMA time slot duration and S/N ratio at the phase lock loop output. Dissert. Abstr.

N72-25556 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON A HYBRID TYPE OF GALERKIN'S EQUATION
H. H. E. Leipholz May 1971 13 p refs
(Grant NRC-A-7297)
(Rept-82) Avail: Issuing Activity

Based on a generalized variational principle, and using the concept of adjoint systems, Galerkin equations of a hybrid-type are derived for a nonself-adjoint boundary value problem. Equations of this type involve coordinate functions generated by a so-called shifted eigenvalue problem. Using the properties of these special coordinate functions, a proof of convergence is given for the hybrid Galerkin equations. Author

N72-25557 Waterloo Univ. (Ontario). Solid Mechanics Div.
THE ALGEBRAIC EIGENVALUE PROBLEM: A SET OF FORTRAN SUBROUTINES
G. M. L. Gladwell and U. C. Tahbildar Mar. 1972 31 p refs
(Rept-18) Avail: Issuing Activity

A sequence of FORTRAN subroutines is described which converts the eigenvalue problem (A - lambda B) x = 0, where A, B are symmetric and B is positive definite, into the standard form, and finds its eigenvalues and eigenvectors by Householder's reduction to tridiagonal form, and backtransformation. The eigenvalues of the tridiagonal matrix may be found by the rational QR algorithm or the Sturm sequence method. A second complete subroutine finds the eigenvalues in the general case when A, B are not symmetric and one or both may be singular. Sample programs are given together with input instructions and a full listing of the subroutines. Author

N72-25558*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
CONTROL OF FUNCTIONAL DIFFERENTIAL EQUATIONS WITH FUNCTION SPACE BOUNDARY CONDITIONS
H. T. Banks 18 Apr. 1972 24 p refs Presented at Park City Differential Equations Symp., Park City, Utah, 7-11 Mar. 1972
(Grants NGR-40-002-015; Contract DA-31-124-ARO (D) 270)
(NASA-CR-126769) Avail: NTIS HC $3.25 CSCL 12A

Problems involving functional differential equations with terminal conditions in function space are considered. Their application to mechanical and electrical systems is discussed. Investigations of controllability, existence of optimal controls, and necessary and sufficient conditions for optimality are reported. K.P.D.

N72-25559*# Brown Univ., Providence, R.I.
STOCHASTIC STABILITY
H. J. Kushner Feb. 1972 39 p refs
(Grants NGL-40-002-015; AF-AFOSR-2078-71; NSF GK-31073X)
(CDS-TR-72-2; NASA-CR-126748) Avail: NTIS HC $4.00 CSCL 12A

The field of stochastic stability is surveyed, with emphasis on the invariance theorems and their potential application to systems with randomly varying coefficients. Some of the basic ideas are reviewed, which underlie the stochastic Liapunov function approach to stochastic stability. The invariance theorems are discussed in detail. Author

N72-25560# RAND Corp., Santa Monica, Calif.
RANDOM REGULAR TOURNAMENTS
Joel H. Spencer Jan. 1972 35 p refs
(P-4479) Avail: NTIS HC $3.75

A tournament T may be represented by a set of ordered pairs (i, j) where this set represents i beat j. The game between i and j with winner undetermined is represented by i, j. T may also be represented by its tournament matrix. A common motif in the theory of tournaments is the probabilistic method. How to prove properties of a random element of the class of regular tournaments is considered. Author

N72-25561*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CONTRIBUTION TO THE CONTROLLABILITY OF TIME-LAG SYSTEMS
A. K. Choudhury Aug. 1971 20 p refs
(NASA-TM-X-65888; X-751-71-384) Avail: NTIS HC $3.00 CSCL 12A

Necessary and sufficient conditions of complete controllability of a class linear, time invariant, delay differential system are presented, and the result is expressed in an algebraic form. Author

N72-25562*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GENERATION OF THE INVARIANT COEFFICIENTS OF THE CHARACTERISTIC POLYNOMIAL FOR AN nxn MATRIX
P. R. Beaudet (Computer Science Corp.) and J. L. Maury Jan. 1972 17 p
(NASA-TM-X-65885; X-552-72-9) Avail: NTIS HC $3.00 CSCL 12A

In theories of numerical stability, roots to a characteristic polynomial are sought, which, in the case of the predictor with iterative correction method of numerical integration, are eigenvalues of a matrix whose elements depend on the coefficients used in the integration process. The characteristic polynomial is displayed explicitly in terms of the elements of the characteristic matrix. Author

N72-25563*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE LEAST SQUARES PROCESS OF MEDIA FOR COMPUTING DRVID CALIBRATION POLYNOMIALS
R. K. Leavitt 15 May 1972 59 p refs
(Contract NAS7-100)
(NASA-CR-126970; JPL-TM-33-542) Avail: NTIS HC $5.00 CSCL 12A

A process is described and evaluated for computing a least squares polynomial approximation of data points in which the optimum degree of the polynomial is automatically determined. An iterative smoothing technique is used to replace every point with the value taken on by a moving least squares polynomial computed from a subset of points centered at the point to be replaced. The optimum degree of the resulting polynomial approximation is determined by analyzing the finite differences of each successive set of smoothed points. To evaluate the process, both artificially constructed data and actual Mariner Mars 1971 (MM'71) tracking data are used. This process was incorporated into a transmission media calibration computer program (MEDIA), which calibrates radiometric data to overcome the effects on the tracking signal of charged particle media. MEDIA was used in support of MM'71. Author

N72-25564# Technische Hochschule Darmstadt (West Germany).
CHARACTERIZATION OF METRIC PLANES BY TRANSFORMATION AXIOMS Ph.D. Thesis [KENNZEICHNUNG METRISCHER EBENEN DURCH BEWEGLICHKEITSAXIOME]
Jose A. Marasigan 1971 63 p refs In GERMAN
Avail: NTIS HC $5.25

Orthogonal collineation is used to formulate Bachmann planes and metric planes through axiom systems. A metric incidence structure is utilized to generate transformation axioms by weakening the following theorems: (1) two into each other movable lines are reflectable into each other; (2) two into each movable points are reflectable into each other; and (3) an orthogonal transformation that locks a set in an element of a Klein four group. The rigidity axiom plays a central roll in group theory formulations for the three homologous systems.
Transl. by G.G.

N72-25565# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THE RIEMANN MAPPING EQUATION IN CONSTRUCTIVE ANALYSIS Ph.D. Thesis [DER RIEMANNSCHE ABBILDUNGSSATZ IN DER KONSTRUKTIVEN ANALYSIS]
Rita Jeltsch 1971 79 p refs In GERMAN
(Diss-4707) Avail: NTIS HC $6.00
A complex constructive analysis is developed by transferring calculable points, point sequences and steady functions into complex systems. Newly derived is the concept of the calculable space and its application in defining the holomorphic function in a calculable space. It is shown that calculable spaces exist whose conformal Riemann functions are not holomorphic.
Transl. by G.G.

N72-25566# Eidgenossische Technische Hochschule, Zurich (Switzerland).
A CONVERGENT ITERATION PROCEDURE FOR CALCULATING THE ROOTS OF A POLYNOMIAL Ph.D. Thesis [EIN KONVERGENTES INTERATIONSVERFAHREN ZUR BERECHNUNG DER WURZELN EINES POLYNOMS]
Willy Kellenberger 1971 108 p refs In GERMAN
(Diss-4653) Avail: NTIS HC $7.50
A convergent iteration procedure for determining the roots of a polynomial is described. The procedure is based on a practical universal algorithm. The method of Nasita-Nickel is described as the basis for the procedure followed. Several theorems are proven to illustrate the steps involved in developing the algorithm. Mathematical models are developed to support the theoretical considerations. A computer program for conducting the machine calculation of the procedure is included.
P.N.F.

N72-25567# Eidgenossische Technische Hochschule, Zurich (Switzerland).
TORSION DECOMPOSITION OF FINITE CW COMPLEXES Ph.D. Thesis
Paul G. Ledergerber 1971 41 p refs
(Diss-4460) Avail: NTIS HC $4.25
A numerical analysis of torsion decomposition of finite CW-Complexes is presented. The analysis is based on two definitions. The first definition is that identification spaces are considered as sets of equivalence classes of points of a given space with the largest topology for which the function sending each point into the class it represents is continuous. The second premise is that torsion spaces are defined as spaces with base point having a homotopy-commutative coproduct structure for which the constant map has finite order in the semigroup of homotopy classes of maps from the space into itself. Author

N72-25568# Eidgenossische Technische Hochschule, Zurich (Switzerland).
STATIONARY ALGORITHM FOR THE NUMERICAL DETERMINATION OF EIGENVALUES FOR A POSITIVE QD LINE AND THE RESIDUES OF THE CORRESPONDING GENERATING FUNCTION Ph.D. Thesis [NUMERISCHE BESTIMMUNG DER EIGENWERTE EINER POSITIVEN QD-ZEILE UND DER RESIDUEN DER ZUGEORDNETEN ERZEUGENDEN FUNKTON MIT HILFE EINES STATIONAEREN ALGORITHMUS]
Talaat Hilal 1971 86 p refs In GERMAN
(Diss-4624) Avail: NTIS HC $6.50
Eigenvalue calculations for a quotient-difference linear transformation in a tridiagonal matrix are reported. Iterative methods prove that sequential processes provide approximated true eigenvalues even if truncation errors are present in the calculation.
Transl. by G.G.

N72-25569# Eidgenossische Technische Hochschule, Zurich (Switzerland).
UPPER AND LOWER LIMITS ON THE MINIMAL EIGENVALUE, RESPECTIVELY THE ENERGY INTEGER IN PROBLEMS THAT CONTAIN AN ALPHA PARAMETER Ph.D. Thesis [OBERE UND UNTERE SCHRANKEN FUER DEN TIEFSTEN EIGENWERT BZW.DAS ENERGIEINTEGRAL IN PROBLEMEN, DIE EINEN PARAMETER ALPHA ENTHALTEN]
Rene Peter Sperb 1971 69 p refs In GERMAN
(Diss-4727) Avail: NTIS HC $5.50
The minimal eigenvalue lambda,(alpha) or the energy integral P(alpha) are approximated for problems where one parameter alpha is linear in the boundary conditions. Lambda,(alpha) or P(alpha) are approximated by lambda sub 1(0),lambda,(to infinity) resp. by P(0), P(to infinity) as are other eigenvalues and geometrical shapes. Considered are the following three problems: (1) an elastically supported membrane; (2) a stationary heat flow; and (3) an elastically supported oscillating plate.
Transl. by G.G.

N72-25570# Eidgenossische Technische Hochschule, Zurich (Switzerland).
SOLUTION FOR BOUNDARY VALUE PROBLEM OF DISTURBED KEPLER MOTION IN REGULATED VARIABLES Ph.D. Thesis [LOESUNG DER RANDWERTAUFGABE DER GESTOERTEN KEPLERBEWEGUNG IN REGULARISIERTEN VARIABLEN]
Bruno Stanek 1971 78 p refs In GERMAN
(Diss-4676) Avail: NTIS HC $6.00
A method is reported for the transformation of motion equations in the disturbed Kepler boundary problem. Considered is an integral equation that contains only perturbation forces in its kernel and whose rapid convergence is assured by the transformation of the equations of motion to linear oscillation equations through generalization of the variables in space. The theory is connected to celestial mechanics in an example calculation for the Hill potential of a third body moving in a circular orbit of the equatorial plane.
Transl. by G.G.

N72-25571# Asian Inst. of Tech., Bangkok (Thailand).
SOME CONVERGENCE THEOREMS IN AVERAGING THEORY
Jean G. Dhombres 30 Sep. 1971 40 p refs
(TN-34) Avail: NTIS HC $4.00
The fundamental problem of averaging theory in mathematics are presented. A characterization of positive operators in terms of norms is given. An extended version of Korovkin's theorem ensuring the convergence of some sequences of positive linear operators is discussed, and applications are considered. Author

N72-25572# Eidgenossische Technische Hochschule, Zurich (Switzerland).
CATEGORIES WITH MODELS, PREGROUPS, AND COALGEBRAS Ph.D. Thesis [CATEGORIES AVEC MODELES, PREFAISCEAUX ET COALGEBRES]
Claude Gronstein 1971 48 p refs In FRENCH
(Diss-4670) Avail: NTIS HC $4.50
The principles of the theory of categories with models are reviewed. The characteristics are presented for the functions F which belong to the subcategory of contravariant functions, a subcategory represented in the equivalence relation between a coalgebraic category and the subcategory under discussion. The structure of a coalgebraic function F is described, and the coalgebraic functions are characterized by their behavior for certain types of diagrams.
Transl. by K.P.D.

N72-25573# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON UTILIZATION OF THE INTEGRAL RELATIONS METHOD TO CONSTRUCT MESH SCHEMES IN THE POISSON EQUATION CASE
A. V. Samusenko [1972] 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSR, Ser. Fiz. Matem. Nauk (Mingk), no. 1, 1972 p 81-85
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill.

Difference schemes are obtained using the method of integral relations. Matrices based on parameters assigned numerical values are also constructed. K.P.D.

N72-25574# Army Foreign Science and Technology Center, Charlottesville, Va.
VIBRATIONS OF NONLINEAR SYSTEMS. THE METHOD OF INTEGRAL EQUATIONS
E. N. Rozenvasser 27 Aug. 1971 533 p refs Transl. into ENGLISH of the book "Kolebaniya Nelineinykh Sistem. Method Integralnykh Uravnenii" USSR
(AD-738124; EFSTC-HT-23-472-71) Avail: NTIS CSCL 12/1

Many diverse applied methods of investigating oscillations of nonlinear systems often in different mathematical formulations and outwardly not related to each other have been developed at the present time. The book deals with a systematic examination of several applied problems in the theory of nonlinear oscillations using the method of integral equations. By this approach it proves possible to establish an intimate relationship between small-parameter classical methods and the methods of investigating nonlinear systems of automatic control based on the so-called filter hypothesis, and to give the latter a rigorous foundation. All the results thus obtained are applicable to a broad class of systems described by nonlinear operator equations. The book also considers certain problems of periodic oscillations unrelated to the use of integral equations. GRA

N72-25136# Joint Publications Research Service, Arlington, Va.
PROBLEMS OF COMPLEX SYSTEM MODELING AND APPLIED MATHEMATICAL STATISTICS
O. G. Ivakhnenko *In its* Cybernetics Res. Reported 23 May 1972 p 1-13 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-25575 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 109, NO. 1: STATIONARY MODELS OF BAROTROPIC AND BAROCLINIC PLANETARY BOUNDARY LAYERS [METEOROLOGISCHE ABHANDLUNGEN. BAND 109, HEFT 1: STATIONAIRE MODELLE BAROTROPER UND BAROKLINER PLANETARISCHER GRENZSCHICHTEN]
Helmut Griesseier 1971 80 p refs In GERMAN
Avail: Issuing Activity

An equation system is formulated that describes the motions of a stationary planetary boundary layer, and friction theorem that considers the effects of small turbulences and convective processes is used to integrate these equations. Obtained characteristic barotropic and baroclinic values represent the steady curve of the surface deflection angle beyond the equator and the decrease of the supergeotropical wind in the vicinity of the friction height. Friction dependent vertical velocity at the planetary boundary layer surface is incorporated into an atmospheric circulation model as the lower boundary condition. Transl. by G.G.

N72-25576 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 120, NO. 11: RESULTS OF THE SYNOPTIC SERVICE DURING 1971. DAILY WEATHER MAPS (GROUND, 500 mb), TABLES, AND BRIEF SCIENTIFIC ARTICLES, NOVEMBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 120, HEFT 11: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1971. TAEGLICHE WETTERKARTEN (BODEN, 500 mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE]
1971 204 p In GERMAN
Avail: Issuing Activity

The detailed results of radiosonde ascents and ground measurements performed during November, 1971 are presented. Using these data, monthly and daily temperature cross sections and the zonal and meridional wind components at ground level and 500 mb heights are constructed. Extreme and mean values of temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and precipitation are included. Brief scientific studies cover fog formation in Berlin and the description of a sand storm on Mars. Transl. by G.G.

N72-25577 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 126, NO. 3: THE EUROPEAN CLIMATOLOGY 1971. WEATHER SATELLITE DATA FROM THE BERLIN ZONE OF RECEPTION, PART 3 [METEOROLOGISCHE ABHANDLUNGEN. BAND 126, HEFT 3: DAS EUROPAEISCHE WETTERBILD 1971. WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH, TEIL III, 3. VIERTELJAHR]
1971 84 p refs In GERMAN
(QR-3-Pt-3) Avail: Issuing Activity

ESSA 8 satellite observations are used to construct daily European weather cloud mosaics during the third quarter of 1971. All cloud reliefs include the geographic coordination nets obtained from sub-satellite points and median satellite orbital heights. Transl. by G.G.

N72-25578# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, JULY 1971
1971 311 p refs
Avail: NTIS HC $17.75

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N72-25579# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, AUGUST 1971
1971 346 p refs
Avail: NTIS HC $19.50

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N72-25580# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, SEPTEMBER 1971
1972 295 p refs
Avail: NTIS

Daily upper air data, corrected for temperature error and curvature of the earth, are presented for Japan and its vicinity. The tables include standard pressure levels, temperature and humidity levels, wind levels, pilot-balloon data, and rocketsonde data. Author

N72-25581# National Weather Service, Silver Spring, Md.
THE USE OF MODEL OUTPUT STATISTICS (MOS) TO ESTIMATE DAILY MAXIMUM TEMPERATURES
John R. Annett, Harry R. Glahn, and Dale A. Lowry Mar. 1972 20 p refs
(NOAA-TM-NWS-TDL-45) Avail: NTIS HC $3.00

A statistical method for objectively producing forecasts of daily maximum temperatures from numerical model output was developed. The screening-regression technique is used to relate maximum temperature observations to variables forecast by two existing numerical models, the subsynoptic advection model and primitive equation model. Conclusions are drawn as to the optimum number of predictors to include in the regression equations to minimize the mean absolute error (MAE) of the forecasts. Inclusion of the sine and cosine of the day of the year as variables in the screening procedure is shown to be an effective method for reducing forecast bias and for improving the accuracy of forecasts. Monthly verification figures covering a 2 1/2-year period for 16 stations in the eastern portion of the United States show that the MAE of the forecasts is about 3.0 to 4.0 F. Author

N72-25582*# National Aeronautics and Space Administration, Washington, D.C.
SATELLITE CLIMATOLOGY
K. Ya. Kondratyev Jun. 1972 80 p refs Transl. into ENGLISH of the book "Sputnikova Klimatologiya" Leningrad, Hydrometeorol. Press, 1971
(NASA-TT-F-723) Avail: NTIS HC $3.00 CSCL 04B

The problem of the classification of cloudiness on the basis of satellite data and the regularities of the planetary distributions of cloud cover was discussed thoroughly. The possibilities of working out semiempirical procedures were discussed for determining the fields of temperature, moisture content, precipitation, vertical motions, and the distribution of snow and ice covers on the basis of utilizing television and infrared information and also on the basis of information about the emergent radiation fields in various regions of the spectra. The distinctive features of the spatial-temporal variability of the global radiation balance of the earth atmosphere system and its components are analyzed in detail. A comparison of the data of the experimental and computational radiation climatology of the earth is made. Author

N72-25583# National Oceanic and Atmospheric Administration, Washington, D.C.
THE USE OF SATELLITE-OBSERVED CLOUD PATTERNS IN NORTHERN-HEMISPHERE 500-MB NUMERICAL ANALYSIS
Roland E. Nagle and Christopher M. Hayden Apr. 1971 54 p refs
(NOAA-TR-NESS-55) Avail: NTIS HC $4.75

A quasi-objective method for deriving 500-mb geopotential heights with the aid of satellite cloud observations is presented. The method uses satellite-observed cloud patterns in conjunction with a forecast 500-mb height field which is separated into additive short and long wave component fields. Empirical relationships between the cloud patterns and the short wave component field are used to modify the pattern of the latter, and regression equations are used to specify extrema values. The 500-mb heights are retrieved by the direct addition of the modified short wavelength field to the long wavelength field. Procedures for using this method operationally are presented, and results of real time application are shown. Author

N72-25584# Bureau of Mines, Bartlesville, Okla.
A FIELD SURVEY OF EMISSIONS FROM AIRCRAFT TURBINE ENGINES
F. W. Cox, F. W. Penn, and J. O. Chase 1972 32 p refs
(BM-RI-7634) Avail: NTIS HC $3.75

Exhaust emissions were measured from 25 aircraft turbine engines using Jet A fuel. Analytical apparatus, procedures, and results are described. Carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, and aldehydes were measured at engine operating modes representing power levels used in airline operation. Carbon monoxide, hydrocarbon, and aldehyde emissions were highest at idle and lowest at takeoff; oxides of nitrogen were lowest at idle and highest at takeoff. Of the total oxides of nitrogen emitted, nitrogen dioxide constituted from 10 to 100 pct, depending on the exhaust gas temperature. Engines retrofitted with smoke reducing burner cans produced less carbon monoxide, hydrocarbon, and aldehyde emissions, and slightly more oxides of nitrogen than engines with standard burner cans. Author

N72-25585# Environmental Protection Agency, Washington, D.C.
THE CLEAN AIR ACT AS AMENDED Annual Report
[1971] 83 p
Avail: NTIS HC $6.25

The duties of the Environmental Protection Agency (EPA) as charged by the Clean Air Act are discussed along with the actions for achieving a 90% reduction in automotive emission of hydrocarbons and carbon monoxide by 1975, and oxides of nitrogen (NOX) by 1976. Topics discussed include: (1) a brief history of federal and state emission control, (2) overview of EPA's program and activites related to control of motor vehicle emissions, (3) health and welfare effects of motor vehicle pollutants, (4) programs reported by industry, and (5) costs associated with motor vehicle emissions control. It is concluded that a major technological challenge faces the nation's auto industry in meeting these emission standards, as the levels of hydrocarbons and carbon monoxide are reduced by increasing the efficiency of combustion, which tends to increase the levels of NOX. The estimated cost increases range from $80 to $600 per car for 1975. F.O.S.

N72-25586# Commerce Dept., Washington, D.C.
FEDERAL METEOROLOGICAL HANDBOOK NO. 6: UPPER WIND CODE
1 Jan. 1972 68 p
Avail: SOD $2.00

Information of a general nature, such as general procedures, definitions of terms, etc. on upper atmosphere meteorology is presented. The coding of upper wind reports by stations on U.S. territory in North and Central America (WMO Region 4) and the North Pacific area (WMO Region 5) and the code tables required in coding the reports are discussed. The complete Upper wind code form as adopted by the World Meteorological Organization (WMO), plus the operating notes and code tables required for its use are given. Author

N72-25587# Commerce Dept., Washington, D.C.
FEDERAL METEOROLOGICAL HANDBOOK NO. 4: RADIOSONDE CODE (STANDARDS AND PROCEDURES FOR THE CODING OF RADIOSONDE REPORTS)
1 Jan. 1972 84 p refs Prepared in cooperation with DOD and DOT
Avail: SOD $2.25

A handbook of standards and procedures applicable to U.S. weather stations for coding/decoding radiosonde reports is presented. Codes presented include: those applicable to all U.S. weather stations; those applicable to all U.S. stations in North and Central America, North Pacific, and all civil and military vessels; and codes applicable to military stations. F.O.S.

N72-25588# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Programs.
HYDROCHLORIC ACID AND AIR POLLUTION: AN ANNOTATED BIBLIOGRAPHY
Jul. 1971 105 p refs
(AP-100) Avail: SOD $0.55

This bibliography contains 164 abstracts of documents and articles on hydrochloric acid. These abstracts are numbered sequentially. An author index, a title index, a subject index, and a

geographical location index follow the abstracts. The author index lists all authors individually. Author

N72-25589# Scott Research Labs., Inc., Plumsteadville, Pa.
A STUDY OF AIRCRAFT POWERPLANT EMISSIONS Final Report
Anthony F. Souza 3 Jan. 1971 260 p refs
(Contract EPA-68-04-0037)
(PB-207107; APTD-0916) Avail: NTIS CSCL 13B

Emissions from forty-two light aircraft piston engines and twenty-six military gas turbine engines were measured and documented. Piston engine aircraft were leased from local general aviation suppliers and the engine exhaust emissions tested using a ten mode test cycle during a ground run-up. In addition, crankcase ventilation emissions were measured on six engines and mass emission rates were calculated. Exhaust component concentrations and fuel consumption rates were measured at specified engine operating conditions. The exhaust analyzer readings were converted to pollutant concentrations and mass emission rates. The data were analyzed to determine engine-to-engine variations for each model engine, the effect of hot versus cold start, and the role of engine operating parameters. Author (GRA)

N72-25590# Institut Royal Meteorologique de Belgique, Brussels.
AEROLOGICAL OBSERVATIONS, UCCLE GROUND STATION. QUINQUENNIAL STATISTICS, 1966 - 1970 [OBSERVATIONS AEROLOGIQUES, STATION D'UCCLE. STATISTIQUES QUINQUENNALES, 1966-1970]
1971 175 p In FRENCH
Avail: NTIS HC $10.75

Aerological observations during the period from 1966 to 1970 at Uccle, Belgium, are tabulated. Tables include ground temperature and pressure, temperatures, geopotentials, relative humidities, and winds at specific levels including maximum, minimum, and mean values. ESRO

N72-25591# World Meteorological Organization, Geneva (Switzerland).
CONSOLIDATED REPORT ON THE VOLUNTARY ASSISTANCE PROGRAMME INCLUDING PROJECTS APPROVED FOR CIRCULATION IN 1971 World Weather Watch
Jan. 1972 271 p
(WMO-323) Avail: NTIS HC $15.75

Countries which contribute to the WMO/WWW Voluntary Assistance Program (VAP) are listed together with their contributions and the new research projects approved for circulation during 1971. General remarks on the overall situation of VAP are given and types of equipment needed are listed. A status is given of projects approved for circulation from 1968 through 1970 ESRO

N72-25592# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: SOUTHWEST ASIAN COASTAL MARINE AREAS. VOLUME 6: AREA 21: SOUTH GULF OF OMAN. AREA 22: SOUTHEAST PERSIAN GULF. AREA 23: NORTHEAST PERSIAN GULF. AREA 24: NORTHWEST PERSIAN GULF
Dec. 1971 546 p
(AD-737909) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The area includes South Gulf of Oman, Southeast, Northeast and Northwest Persian Gulf. Author (GRA)

N72-25593# Pratt and Whitney Aircraft, East Hartford, Conn.
COLLECTION AND ASSESSMENT OF AIRCRAFT EMISSIONS BASELINE DATA, TURBINE ENGINES Final Report
A. W. Nelson Feb. 1972 175 p ref
(Contract EPA-68-04-0027)
(PB-207321; PWA-4339) Avail: NTIS CSCL 13B

A report is presented of a study in which the design and fabrication of a multipoint sampling rake was completed. A checkout test of the rake using a JT9D experimental engine indicated that the exhaust emission sample obtained from the rake was very close to the average of the samples obtained from the individual probes located adjacent to the 12 rake sampling points. This probe was then used to sample the exhaust emission from an experimental engine of each of the JT3D, JT8D, and JT9D engine models, plus production engines. All of the mass emission results obtained during the program were subjected to a statistical analysis. The results of this analysis were then used in a hypothetical aircraft operational cycle. Measurements of smoke, dry particulates, total particulates, aldehydes, and olefins were also recorded. Author (GRA)

N72-25777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NIMBUS 4 IRLS METEOROLOGICAL EXPERIMENT
Charles E. Cote *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 96-99 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 04B

N72-25379*# Barnes Engineering Co., Stamford, Conn.
REMOTE DETECTION OF CAT BY INFRARED RADIATION
Robert W. Astheimer *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 517-524 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04B

N72-25380*# IIT Research Inst., Chicago, Ill.
REMOTE SENSING OF WINDS AND ATMOSPHERIC TURBULENCE BY CROSS CORRELATION OF PASSIVE OPTICAL SIGNALS
A. J. Montgomery *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 525-553 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04B

N72-25386*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
VERTICAL PROFILES OF WIND AND TEMPERATURE BY REMOTE ACOUSTICAL SOUNDING
Herbert L. Fox *In* NAS-NRC Atmospheric Exploration by Remote Probes, Vol. 2 Jan. 1969 p 671-679 refs (See N72-25347 16-13)
Avail: NTIS HC $37.50 CSCL 04B

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-25594 Florida Univ., Gainesville.
PROBLEMS IN ATTITUDE STABILITY OF DUAL-SPIN SPACECRAFT Ph.D. Thesis
Amnom Sitchin 1970 90 p
Avail: Univ. Microfilms Order No. 71-24977

The dynamics of dual-spin spacecraft containing an energy dissipating damper are investigated, with special attention to the effects of mass product of inertia and rotor constraints on the

attitude stability. The equilibrium cone angle at which an unbalanced spacecraft will precess in a steady state motion is predicted both for the case of a freely rotating rotor and for the case of a rotor which is constrained by a control system to rotate at a constant speed relative to the main body. The dynamics and stability of the constrained rotor spacecraft are shown to be different from those of the free rotor spacecraft. Cone angles considered are not restricted to small values, without resorting to any linearizations or other approximation procedures. Emphasis is placed on offering a clear physical interpretation of the stability criteria in an effort to enhance the understanding of the dynamics of dual-spin spacecraft and thereby help in design decisions. Dissert. Abstr.

N72-25595* Bell Aerosystems Co., Buffalo, N.Y.
FLIGHT CONTROL SYSTEM Patent
William A. Collins, inventor (to NASA) Issued 16 May 1972 10 p Filed 31 Jul. 1970 Supersedes N70-36003 (08 - 19, p 3592) Sponsored by NASA
(NASA-Case-MSC-13397-1; US-Patent-3,662,973; US-Patent-Appl-SN-59966; US-Patent-Class-244-23A; US-Patent-Class-244-1SA) Avail: US Patent Office CSCL 17G

A thrust control device which may be used with aircraft and spacecraft is described. The roll movements of the craft are controlled through differential throttling of the thrust engines. The pitch and yaw movements are controlled by pivotal movements of the thrust engines. The device has a trimming mechanism to respond to a variety of loading conditions without changing the position of the vehicle operator's controls. P.N.F.

N72-25596 Pennsylvania Univ., Philadelphia.
ANALYSIS OF A SPINNING INTERFEROMETER NAVIGATION SATELLITE CONCEPT Ph.D. Thesis
George Ranjan Thomas 1971 195 p
Avail: Univ. Microfilms Order No. 71-26095

A navigation concept is analyzed, wherein a single radiating interferometer is placed on a spinning synchronous satellite. The L-band continuous-wave signals transmitted by the interferometer antennas are received by the navigating craft as a double-sideband suppressed-carrier (DSB) waveform whose demodulation and subsequent processing form an important part of this study. The DSB signal is coherently demodulated to yield the intelligence. Two of the craft's position coordinates (the altitude being independently measured) are extracted optimally in the maximum a posteriori (MAP) sense from this intelligence. The MAP processor is designed to accept preliminary position information from on-board dead-reckoning equipment and stored a priori information, in addition to the incoming radio signals, to give improved estimates of position. An error analysis reveals that the major contributors to position error are tropospheric phase fluctuations, multipath, uncertainty in user altitude and additive receiver noise. Dissert. Abstr.

N72-25597# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
THE OPTIMALITY OF PROPORTIONAL NAVIGATION
J. K. Hammond Mar. 1972 46 p refs
(AASU-313) Avail: NTIS HC $4.50

Several cost functions are chosen for the judgement of homing systems. Control laws are found to optimize these cost functions and the theoretical optima obtained are compared against the performance of conventional proportional navigation (P/N). The P/N systems are seen to compare very favorably with the optimal systems. Author

N72-25598# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
A SYSTEM FOR AUTOMATIC TIME SYNCHRONIZATION BASED ON THE TIMING CAPABILITY OF THE LORAN-C NAVIGATIONAL NETWORK
Goeran P. R. Netzler May 1971 45 p refs
(RR-104) Avail: NTIS HC $4.25

New concepts in dealing with the circuitry for Loran-C automatic timing systems are described. The conventional analogue techniques associated with phase shifting networks have been replaced by an incremental digital phase shift device. The format identification and decoding equipment together form a system which takes into account the information of every Loran-C pulse. Owing to the use of digital signal treatment the synchronization accuracy is limited only by the resolution of the incremental phase shift. The automatic cycle selection device is based on sampling techniques where the derivative of the envelope is calculated. The system includes an epoch monitor, receiving an initial time information from a local digital clock which has to be accurate to within + or - 20 microseconds. The time of coincidence has to be precalculated and fed into the thumbwheel memory of the epoch monitor, which is automatically initiated when the synchronizing operations are concluded. Author

N72-25599*# Bell Aerospace Co., Buffalo, N.Y.
STUDY OF AUTOMATIC FLARE AND DECRAB GUIDANCE AND CONTROL SYSTEM FOR THE SPACE SHUTTLE Final Report
William Cockayne and Walter Rusnak Jul. 1971 322 p
(Contract NAS2-6077)
(NASA-CR-114436; BAC-6272-933010) Avail: NTIS HC $18.25 CSCL 17G

The automatic landing of an unpowered space shuttle vehicle was studied along with the design of the guidance and flight controls, selection of the ground reference component of the landing system (signals in space), and evaluation of the performance of the overall system. The study was carried out by means of an all-digital simulation which incorporated wind shears, gusts and error models for the hardware components. The performance of the landing system operating in winds and turbulence and with hardware errors was determined by Monte Carlo techniques. It was found that the interactions of turbulence and vehicle characteristics were the limiting factors on system performance. The touchdown errors due to the measurement errors of the ground reference system were less significant. The guidance designed was predictive in the longitudinal direction and fixed path in the lateral direction. Author

N72-25600*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: THE APPLICATION OF A COMPUTERIZED VISUALIZATION CAPABILITY TO LUNAR MISSIONS
Charles T. Hyle and Alfred N. Lunde Washington Jun. 1972 17 p
(NASA-TN-D-6853; MSC-S-323) Avail: NTIS HC $3.00 CSCL 22C

The development of a computerized capability to depict views from the Apollo spacecraft during a lunar mission was undertaken before the Apollo 8 mission. Such views were considered valuable because of the difficulties in visualizing the complex geometry of the Earth, Moon, Sun, and spacecraft. Such visualization capability originally was desired for spacecraft attitude verification and contingency situations. Improvements were added for later Apollo flights, and results were adopted for several real time and preflight applications. Some specific applications have included crewmember and ground control personnel familiarization, nominal and contingency mission planning, definition of secondary attitude checks for all major thrust maneuvers, and preflight star selection for navigation and for platform alinement. The use of this computerized visualization capability should prove valuable for any future space program as an aid to understanding the geometrical relationships between the spacecraft and the celestial surroundings. Author

N72-25601*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA BALLOON: AIRCRAFT RANGING, DATA AND VOICE EXPERIMENT

Sheldon Wishna, C. Hamby, and D. Reed May 1972 69 p refs
(NASA-TM-X-65906; X-752-72-136) Avail: NTIS HC $5.50 CSCL 17G

A series of tests to evaluate, at L-band, the ranging, voice, and data communications concepts proposed for the air traffic control experiment of the Applications Technology Satellite-F are described. The ground station facilities, balloon platforms and the aircraft were supplied by the European Space Research Organization. One ground simulation and two aircraft flights at low elevation angles were conducted. Even under high interference conditions good performance was obtained for both voice communications and side tone ranging. High bit errors occurred in the data channels resulting in false commands. As a result of the experience gained in operating the equipment in an aircraft environment several recommendations were made for improving the equipment performance. Author

N72-25602# Radio Technical Commission for Aeronautics, Washington, D.C.
PLANNED EXPANSION OF FAA TERMINAL NAVAID FACILITIES AND THE RESULTANT NEED FOR CHANNEL SPLITTING IN THE VOR/ILS/DME BANDS
6 Jul. 1971 86 p
(Paper-54-71/SC122-3) Avail: NTIS HC $6.50

The planned expansion of terminal navigation aid facilities and the resultant requirement for channel splitting in the VOR/ILS/DME bands is discussed. Subjects involved in the discussion are: (1) requirements and programs for ILS and VOR, (2) principles of frequency management, (3) geographical separation criteria, (4) computer capability for frequency assignment, (5) present situation in VOR/ILS/DME bands, and (6) plan for phasing in split-channel assignments. Author

N72-25603# Radio Technical Commission for Aeronautics, Washington, D.C. Special Committee 116F.
MINIMUM OPERATIONAL CHARACTERISTICS FOR AIRBORNE VHF OMNIRANGE (VOR) SYSTEMS
14 Jan. 1972 38 p refs
(DO-149) Avail: NTIS HC $4.00; RTCA Secretariat, Suite 655, 1717 H St., N. W., Washington, D. C. 20006: HC $6.00

The requirements for establishing minimum operational characteristics of VHF omnirange navigation systems (VOR) are presented. Subjects discussed are: (1) equipment specifications and environmental standards, (2) international standards, (3) preparation of minimum operational characteristics for airborne VOR systems, and (4) demonstration of compliance and guidance material. P.N.F.

N72-25604*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
GUIDANCE SYSTEM OPERATIONS PLAN FOR MANNED CM EARTH ORBITAL MISSIONS USING PROGRAM SKYLARK 1. SECTION 2: DATA LINKS Apollo Guidance, Navigation and Control
M. H. Hamilton Mar. 1972 149 p
(Contract NAS9-4065; DSR Proj. 55-23890)
(NASA-CR-115663; R-693) Avail: NTIS HC $9.50 CSCL 17G

A computer program to define the digital uplink and downlink for use in manned command module orbital missions is presented. The subjects discussed are: (1) digital uplink to command module, (2) CMC digital downlink, (3) downlist formats, (4) description of telemetered qualities, (5) flagbits, and (6) effects of Fresh Start (V36) and Hardware Restart on flagword and channel bits. P.N.F.

N72-25605# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF STOL MODULAR INSTRUMENT LANDING SYSTEM (MODILS) Final Report, May 1970 - Jul. 1971
Glen D. Adams May 1972 53 p
(FAA Proj. 320-114-02X)
(FAA-NA-72-11; FAA-RD-72-4) Avail: NTIS HC $4.75

The FAA procured two modular instrument landing system (MODILS) ground stations for short take-off and landing (STOL) operational evaluation. MODILS operated at 5.2 GHz (C-band solid-state transmitter), providing localizer and glide slope signals, from a common site, for approach guidance to aircraft equipped with a MODILS receiver. Proportional guidance is provided from 3 to 12 deg elevation and about +30 deg in azimuth. The pilot may select his glide slope angle in increments of 0.1 deg and one of three localizer courses: parallel to runway centerline, 2 deg skew one side and 6 deg skew the other side. The pilot may also select his indicator sensitivities. An integral distance measuring equipment (DME) is included which provides readouts to 0.01 nmi. The system provides good quality guidance signals to adequately support Category i type (200-foot decision height) operations. The consistent DME operating range is about 5 nmi. The monitors are not of commissionable quality due to reliability and stability problems. Author

N72-25606# Royal Aircraft Establishment, Farnborough (England).
A REVIEW OF APPROACH AND LANDING GUIDANCE IN RELATION TO CIVIL AND MILITARY OPERATIONAL REQUIREMENTS
J. Benjamin Sep. 1971 112 p refs
(RAE-TR-71186; BR27181) Avail: NTIS HC $7.75

Trends and developments in aircraft guidance and the likely long term effect on aircraft instrumentation and operations are reviewed. Several organizations are engaged in the formulation of operational requirements suited to the foreseeable needs of civil and military aviation, and effort was devoted to the development of a variety of techniques applied to guidance using microwaves. These requirements, and the solutions that were conceived, constitute a complex technical, commercial, and political pattern. Author (ESRO)

N72-25607# Royal Aircraft Establishment, Farnborough (England).
AN ILS APPROACH PROGRAMME UNIT FOR THE RADIO ENVIRONMENT MONITOR
T. R. G. Lampard Jul. 1971 66 p ref
(RAE-TR-71145; BR27441) Avail: NTIS HC $5.50

A program unit is described which is capable of providing appropriate voltage levels into a signal simulator which in turn supplies the necessary RF signal input to the radio environment monitor in such a way as to simulate an ILS approach by an aircraft. The approach can be simulated with or without the various forms of interference which the monitor is capable of detecting. Author (ESRO)

N72-25608# Stanford Univ., Calif. Guidance and Control Labs.
ADVANCED RESEARCH IN GUIDANCE, CONTROL, AND INSTRUMENTATION Final Report
Daniel B. Debra Sep. 1971 82 p refs
(Contracts F33615-70-C-1637; AF 33(615)-141; AF Proj. 5102)
(AD-738309; AFAL-TR-71-256) Avail: NTIS CSCL 17/7

The report describes research results in orbital tests of instruments, instrument development, and guidance and control techniques, specifically: Development of experiments testing special inertial instruments in a Drag-Free Satellite--The unsupported gyroscope; Orbital tests of existing instruments; He3 nuclear gyro development; Optimal guidance concepts; Sensor design for control of aerodynamic flutter; Gravity gradiometer techniques for airborne applications research. GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-25609*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OUT-OF-CORE EVALUATIONS OF URANIUM NITRIDE FUELED CONVERTERS
K. Shimada 1 May 1972 11 p refs
(Contract NAS7-100)
(NASA-CR-126864; JPL-TM-33-545) Avail: NTIS HC $3.00 CSCL 18I

Two uranium nitride fueled converters were tested parametrically for their initial characterization and are currently being life-tested out of core. Test method being employed for the parametric and the diagnostic measurements during the life tests, and test results are presented. One converter with a rhenium emitter had an initial output power density of 6.9 W/ sq cm at the black body emitter temperature of 1900 K. The power density remained unchanged for the first 1000 hr of life test but degraded nearly 50% percent during the following 1000 hr. Electrode work function measurements indicated that the uranium fuel was diffusing out of the emitter clad of 0.635 mm. The other converter with a tungsten emitter had an initial output power density of 2.2 W/ sq cm at 1900 K with a power density of 3.9 W/sq cm at 4300 h. The power density suddenly degraded within 20 hr to practically zero output at 4735 hr.
Author

N72-25610*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CLOSED-LOOP DYNAMICS OF IN-CORE THERMIONIC REACTOR SYSTEMS
C. D. Sawyer and J. E. Boudreau 15 May 1972 21 p refs
(Contract NAS7-100)
(NASA-CR-126868; JPL-TM-33-546) Avail: NTIS HC $3.25 CSCL 18I

Using a point model of an in-core thermionic converter, alternative schemes for providing closed loop reactor control were investigated. It was found that schemes based on variable gain power regulation buffers which use the reactor current as the control variable provide complete protection from thermionic burnout and also provide a virtually constant voltage to the user. A side benefit is that the emitter temperature transients are small-even for a complete electric load drop the emitter temperature transient is less than 100 deg K. The current regulation scheme was selected for further study with a distributed parameter model which was developed to account for variations in thermionic and heat transfer properties along the length of a cylindrical converter. It was found that even though the emitter temperature distribution is about 200 deg K along the converter length, the dynamic properties are unchanged when using the current control scheme.
Author

N72-25611*# Brookhaven National Lab., Upton, N.Y.
ROTATING FLUIDIZED BED REACTOR FOR SPACE NUCLEAR PROPULSION, ANNUAL REPORT: DESIGN STUDIES AND EXPERIMENTAL RESULTS, JUNE, 1970 - JUNE 1971
Aug. 1971 90 p refs
(NASA-SNSO-IA-13254)
(NASA-CR-126738; BNL-50321(UC-33)) Avail: NTIS HC $6.50 CSCL 18I

The rotating fluidized bed reactor concept is being investigated for possible application in nuclear propulsion systems. Physics calculations show U-233 to be superior to U-235 as a fuel for a cavity reactor of this type. Preliminary estimates of the effect of hydrogen in the reactor, reflector material, and power peaking are given. A preliminary engineering analysis was made for U-235 and U-233 fueled systems. An evaluation of the parameters affecting the design of the system is given, along with the thrust-to-weight ratios. The experimental equipment is described, as are the special photographic techniques and procedures. Characteristics of the fluidized bed and experimental results are given, including photographic evidence of bed fluidization at high rotational velocities.
Author

N72-25612*# Office of Space Nuclear Systems (AEC), Washington, D.C.
NUCLEAR SYSTEMS FOR SPACE POWER AND PROPULSION
Milton Klein [1971] 14 p
(NASA-TM-X-68341; A/Conf.49/P-56; Conf-710901-8) Avail: NTIS HC $3.00 CSCL 18E

As exploration and utilization of space proceeds through the 1970s, 1980s, and beyond, spacecraft in earth orbit will become increasingly larger, spacecraft will travel deeper into space, and space activities will involve more complex operations. These trends require increasing amounts of energy for power and propulsion. The role to be played by nuclear energy is presented, including plans for deep space missions using radioisotope generators, the reactor power systems for earth orbiting stations and satellites, and the role of nuclear propulsion in space transportation.
Author

N72-25613# California Univ., Berkeley. Lawrence Berkeley Lab.
PULSED HEAVY ION SOURCE FOR THE BEVATRON
H. A. Grunder, R. M. Richter, M. M. Tekawa, and E. Zajec Oct. 1971 5 p refs Presented at Intern. Conf. on Multiply-Charged Ion Sources and Accelerating Systems, Gatlinberg, Tenn., 25 Oct. 1971
(Contract W-7405-Eng-48)
(LBL-304; Conf-711021-8) Avail: NTIS

A Philips' ion gauge source of the type used by the heavy ion accelerator in Berkeley was adapted for use at the Bevatron. The objective was to achieve high charge state ions (4+,5+) of carbon and nitrogen. All source parameters are pulsed. The ion source performance regarding linac acceleration is discussed. The light ion (deuteron, alpha) performance of the PIG source and dupoplasmatron is compared
Author (NSA)

N72-25614# European Nuclear Energy Agency, Paris (France).
[EUROPEAN NUCLEAR ENERGY EXPERIMENTAL AND TECHNOLOGICAL ACTIVITIES]
Dec. 1971 87 p refs
(NP-19199) Avail: AEC Depository Libraries

Atomic research progress for 1971 is reported. Data cover environmental safety guidelines, operational safety procedures for reactors, operational and developmental functions of reactor technology, materials control, and licensing and regulating procedures for reactors.
E.H.W.

N72-25615# Texas Technological Univ., Lubbock. Plasma Lab.
RF HEATING OF FUSION REACTORS
M. Kristiansen, M. O. Hagler, and J. E. Cato 15 Mar. 1971 40 p refs
(Contract AT(40-1)-3778)
(ORO-3778-5) Avail: NTIS

An engineering study of RF heating in fusion reactors is described. The frequency range considered is below 100 MHz. Special consideration is given to RF structures located between the reactor wall and the plasma in the main fusion region. Possible arcing problems in this region are discussed, and it is found that they may not be too serious for neutral pressures below 0.0001 torr. It is proposed to feed the RF through a slanted vacuum port in order to reduce port area and to protect the voltage insulator from radiation and temperature damage. The cooling of an RF coil structure is considered in detail. It is

proposed to use a split RF coil composed of heat pipes to carry the heat away. Curves are presented that give the maximum RF ontime for various coil currents, frequencies, and coil sizes before the coil surface reaches melting temperature. Other coupling schemes involving using the vacuum wall as an RF structure or locating a wave launcher in the high field region of a mirror reactor are discussed. Author (NSA)

N72-25616# Radio Corp. of America, Harrison, N.J.
TBC-1 POST-INITIAL TEST EVALUATION REPORT
1 Oct. 1971 35 p ref Prepared for GE Co., Philadelphia, Pa.
(Contract AT(29-2)-2831)
(TID-25901) Avail: NTIS

An attempt was made to determine what caused a power loss in the TBC-1 at 1035 C. A single-point short was detected which by itself would not account for the power loss. Upon return to room temperature and removal of the shell, heavy black, electrically conductive deposits were observed to be randomly distributed on the cold side of the thermopile. This was significant because a distributed short in combination with the single-point short could result in a converter power loss. To determine the cause of the power loss, postulations of failure modes were made for the observed and other possible conditions. Tests and analysis in conjunction with detailed reviews of other data were performed to confirm or reject the postulated modes. It was concluded that the loss of power was due to the combination of a single-point short (cold side instrumentation in parallel rows 1 and 2) and a distributed short (carbonaceous and sodium deposits which bridged most of the cold stack alumina ceramics). Author (NSA)

N72-25617# Atomic Energy Commission, Washington, D.C.
MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS, JANUARY - DECEMBER 1971
Jan. 1972 57 p refs
(TID-25940) Avail: NTIS

Research, covering radioactive waste management, waste disposal operations in the deep Atlantic, gas cooled reactor development, and health safety, is reported. Major emphasis was on an international program for determining wholesomeness of irradiated foodstuffs. E.H.W.

N72-25618# Atomics International, Canoga Park, Calif.
SNAP REACTOR PROGRAMS Progress Report, Aug - Oct. 1971
23 Dec. 1971 84 p refs
(Contract AT(04-3)-701)
(AI-AEC-13017) Avail: NTIS

Core thermal and hydraulic studies were conducted to further examine worst case core thermal conditions as the basis for fuel element and thermal stress analysis. Fin-on-tube structural tests were conducted to evaluate fin geometries and cladding contact stresses for both the Hastelloy X and Incoloy 800 fuel element configurations. The margins of safety for Hastelloy X are considerably greater in the as-fabricated conditions and the core assembly condition, as well as during normal operation. Trade-off studies were performed on burnable poisons with the results favoring a 50/50 mixture of natural Gd and Eu-151 for the SPF reactor. Additional NaK heat transfer testing was performed with smooth heaters simulating fuel elements space at a P/D of 1.05. The experimental results are in good agreement with the analytical predictions. An S8DR design actuator was subjected to vibration loads expected during launch of a Saturn 5 booster. No damage or effects on performance were detected at these loads or at loads several times higher. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-25619* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIUM REFRIGERATOR AND METHOD FOR DECONTAMINATING THE REFRIGERATOR Patent
Ervin R. Wiebe, inventor (to NASA) Issued 18 Apr. 1972 5 p Filed 5 Feb. 1971 Supersedes N72-11567 (10 - 02, p 225) Sponsored by NASA
(NASA-Case-NPO-10634; US-Patent-3,656,313;
US-Patent-Appl-SN-112999; US-Patent-Class-62-85;
US-Patent-Class-62-80; US-Patent-Class-62-475;
US-Patent-Class-62-6) Avail: US Patent Office CSCL 20L

A heat exchanger is described for use in a multistage refrigeration system. The device has a hermetically sealed housing and contains a pair of chambers, defining a pair of concentrically related countercurrent passages extending through it. A feature of the invention is a decontaminating system which includes a circuit pneumatically coupled with a given heat exchanger and adapted to vent the heat exchanger to the atmosphere and to flush the vented heat exchanger with a gas delivered under pressure and at ambient temperature, so that frozen contaminants are melted and simultaneously expelled from the system. Official Gazette of the U.S. Patent Office

N72-25620 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
NOISE LEVELS AND OCTAVE BAND ANALYSIS OF THE NOISE EXISTING IN COMPANHIA VIDRARIA SANTA MARINA, WITH CONCLUSIONS ON INSALUBRITY PRODUCED BY NOISE POLLUTION
L. X. Nepomuceno 19 Jan. 1972 12 p refs in PORTUGUESE; ENGLISH summary
(TR-7201.561) Avail: Issuing Activity

The results of the noise measurements and spectral analysis for the Vidraria Company are presented. The measurements are tabulated with reference to international standards. Results indicate that the noise levels are within acceptable international standards. Criticisms of the current Brazilian noise control laws are included. Transl. by F.O.S.

N72-25621 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
SOUND LEVEL MEASUREMENTS, OCTAVE BAND ANALYSIS OF NOISE IN OBJETIVO'S INSTALLATIONS AND IN COMPLAINING NEIGHBOURS AND SUGGESTED SOLUTION FOR THE PROBLEM
L. X. Nepomuceno 10 Nov. 1971 20 p In PORTUGUESE; ENGLISH summary
(TR-7111.549) Avail: Issuing Activity

The report presents the results obtained with sound level measurements and octave band analysis for noise observed in Colegio Objetivo installations. The results are presented in spectrum curves, and a proposal for the solution of their noise problem in each room is included. Author

N72-25622 Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
SOUND LEVEL MEASUREMENTS, OCTAVE BAND ANALYSIS OF NOISE PRODUCED BY A LARGE SIZE DIESEL ENGINE, WITH COMMENTS AND CRITIQUES OF THE ACTUAL BRAZILIAN LEGISLATION
L. X. Nepomuceno 8 Feb. 1972 22 p refs In PORTUGUESE; ENGLISH summary
(TR-7202.564) Avail: Issuing Activity

The results are presented of measuring noise levels produced by a large maritime-type diesel engine with a silencer. The measurements are analyzed for the engine operating under fully loaded conditions. The equipment and the procedures are described, and the results are tabulated by db and frequency. Comments concerning the impracticality of Brazilian legislation on noise control are included. Transl. by F.O.S.

N72-25623*# Princeton Univ., N.J.
RANDOM EXCITATION OF A PANEL-CAVITY SYSTEM
George F. Gorman, III Jul. 1971 27 p refs
(Grant NGR-31-001-146)
(NASA-CR-112051; AMS-1009) Avail: NTIS HC $3.50 CSCL 20A

An experimental investigation of the influence of random external sound field on cavity pressure and panel vibration is presented. The panel used was 10 in. x 20 in. x 0.05 in. aluminum alloy plate that was bonded onto a rectangular frame consisting of aluminum channel members welded together at their ends. By bonding the plate to the cavity in this way, a clamped edge boundary condition was approximated. A sealed cavity was constructed beneath the panel in such a way that the cavity depth could be varied in 2 in. increments from 12 in. to 2 in. deep. In order to vary the cavity depth, the cavity was built in sections. Each 2 in. section of the cavity was bolted to the other sections with rubber gaskets between them. The panel was excited acoustically by a Wolverine LS15, 20 watt loudspeaker driven by a B and K random noise generator, Type 1402. The external sound field was measured on the panel surface, using the 6 percent bandwidth of the frequency analyzer. Author

N72-25624*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
SOLAR SYSTEM APPLICATIONS OF MIE THEORY AND OF RADIATIVE TRANSFER OF POLARIZED LIGHT
Laird Peter Whitehill Mar. 1972 293 p refs
(Grants NGR-33-010-101; NGR-33-101-082; NSF GA-23945)
(NASA-CR-126753; CRSR-483) Avail: NTIS HC $16.75 CSCL 20F

A theory of the multiple scattering of polarized light is discussed using the doubling method of van de Hulst. The concept of the Stokes parameters is derived and used to develop the form of the scattering phase matrix of a single particle. The diffuse reflection and transmission matrices of a single scattering plane parallel atmosphere are expressed as a function of the phase matrix, and the symmetry properties of these matrices are examined. Four matrices are required to describe scattering and transmission. The scattering matrix that results from the addition of two identical layers is derived. Using the doubling method, the scattering and transmission matrices of layers of arbitrary optical thickness can be derived. The doubling equations are then rewritten in terms of their Fourier components. Computation time is reduced since each Fourier component doubles independently. Computation time is also reduced through the use of symmetry properties. Author

N72-25625 Laboratorio de Acustica e Sonica, São Paulo (Brazil).
ATTENUATION OF SOUND RADIATION FROM PLATES THROUGH RESILIENT BONDED MATERIAL
L. X. Nepomuceno 21 Jul. 1971 36 p In PORTUGUESE; ENGLISH summary
(Rept-7107.521) Avail: NTIS HC $4.00

The theory and method adopted for the measurement of sound attenuation are presented for noise from plates after mechanical impact. A comparison was made between plates covered with an anticorrosive product and those covered with resilient bonded materials of different compositions and base. The results are presented in tabular form, with the curves for attenuation acceleration and sound emitted by the impact of steel balls. Author

N72-25626# Polish Academy of Sciences, Warsaw. Inst. of Fundamental Technical Research.
SCIENTIFIC ACTIVITIES OF THE INSTITUTE OF FUNDAMENTAL TECHNICAL RESEARCH IN 1970
Marek Sokolowski, ed. 1971 81 p refs
Avail: NTIS HC $6.25

Research programs in several areas of mechanics, acoustics, and engineering and technical physics are briefly summarized. These fields of investigation are the following: Theory of continuous media; continuum and structural mechanics; static and dynamic strain fields; polymer physics; wave propagation in elastic-plastic media and electronics; fluid mechanics; dynamics of mechanical systems; propagation of acoustic and ultrasonic waves in solids and fluids; ultrasonic applications in biology and medicine; electro-acoustics and acoustic phonetics; nondestructive testing of structural alloys; atomic frequency standards; and electromagnetic wave theory for radio communication. N.E.N.

N72-25627*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR NONDESTRUCTIVE TESTING Patent Application
James M. Hoop, inventor (to NASA) Filed 20 Apr. 1972 14 p
(NASA-Case-MFS-21233-1; US-Patent-Appl-SN-246056) Avail: NTIS HC $3.00 CSCL 20N

A high voltage is applied to an arc gap adjacent to a test specimen to develop a succession of high frequency arc discharges. These high frequency arc discharges generate pulses of ultrasonic energy within the test specimen without requiring the arc discharges to contact the specimen and without requiring a coupling medium between discharges and specimen. The pulses can be used for detection of flaws, for measurement of certain properties of the test specimen, and for m asurement of stresses within the specimen. NASA

N72-25628*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL SERVOCONTROL OF RANDOM SOUND TEST EXCITATION Patent Application
Robert B. Nakich, inventor (to NASA) Filed 16 Mar. 1972 49 p
(Contract NAS7-100)
(NASA-Case-NPO-11623-1; US-Patent-Appl-SN-235338) Avail: NTIS HC $4.50 CSCL 20A

A digital servocontrol system for random noise excitation of a test object in a reverberant acoustic chamber employs a number of sensors to produce signals in separate channels which are decorrelated and averaged. The average signal is divided into a number of adjacent frequency bands cyclically sampled by a time division multiplex system, converted into digital form, and compared to a predetermined spectrum value stored in digital form. The result of the comparisons are used to control a time-shared up-down counter to develop gain control signals for the respective frequency bands in the spectrum of random sound energy picked up by the microphones. NASA

N72-25629# Northeastern Univ., Boston, Mass. Dept. of Physics.
ELECTRON GAS AT METALLIC DENSITIES
Gerd Keiser and F. Y. Wu Apr. 1972 30 p refs
(Grant NSF GP-25306)
(NUB-2126) Avail: NTIS HC $3.50

The ground state properties of an electron gas at metallic densities were investigated using the Wu-Feenberg theory of Fermi liquids. The ground state was found to be paramagnetic and the correlation energy, the low temperature specific heat, and the spin susceptibility were computed. Perturbative correction to the correlation energy due to the particle-hole excitations in a correlated basis function formulation was found to be insignificant. Author

N72-25630*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RING CURRENT
Masahisa Sugiura May 1972 24 p refs Presented at 15th plenary meeting of COSPAR, Madrid, 10-24 May, 1972
(NASA-TM-X-65904; X-645-72-176) Avail: NTIS HC $3.25 CSCL 20C

It is proposed that the quiet-time ring current consists of two parts, the inner ring current imbedded deeply inside the plasmapause and the outer ring current flowing in the plasma sheet. The source of the inner ring current appears to be trapped protons with energies 100 keV to several hundred keV having their peak intensity at 3 to 4 R sub e. The dominant source of the outer ring current is the population of protons with energy near 50 keV in the plasma sheet, as in Frank's (1967) model for the extraterrestrial ring current. The outer ring current is an innermost part of the tail current, and the inner ring current is its earthward extension. The plasma pressure is nearly continuous from the plasma sheet to the inner current ring region. When the plasma sheet moves inward during a substorm, the plasma pressure increase is directly conveyed to inside the plasmasphere and intensifies the inner ring current. Author

N72-25631*# Cornell Univ., Ithaca, N.Y. Graduate School of Aerospace Engineering.
FOCUSING OF FINITE-AMPLITUDE CYLINDRICAL AND SPHERICAL SOUND WAVES IN A VISCOUS AND HEAT-CONDUCTING MEDIUM Ph.D. Thesis
Tek-che Chu Dec. 1971 100 p refs
(Grant NGL-33-010-054)
(NASA-CR-112095) Avail: NTIS HC $7.00 CSCL 20A

The focusing of acoustic pulses is studied analytically by considering the region of study in three parts: the converging, interaction and diverging regions. First, the linear problem of a pulse of infinitesimal amplitude is studied. For the spherical case, the expected phase change as a result of focusing is verified. The nonlinear case of finite-amplitude pulses leads to the development of M-waves, as determined by applying the method of matched-asymptotic expansions to Burges equation. Author

N72-25632# Pratt and Whitney Aircraft, East Hartford, Conn.
APPLICATION OF THEORETICAL ACOUSTIC TO JET ENGINE NOISE REDUCTION
J. D. Kester and G. F. Pickett [1971] 20 p refs Presented at Conf. on Reduction of Aircraft Noise, Bristol, Engl., 13-14 Jan. 1971 Sponsored in Part by FAA
Avail: NTIS HC $3.00

A now classical example of the application of theory to rotor-stator interaction noise is discussed to illustrate how noise generation, propagation, and reduction data can be obtained from a simple theoretical model. Some of the problems arising from predicting noise levels of interaction tone noise are considered. Some of the more recent work associated with the study of combination tone or multiple pure tone noise is described. This noise is produced in the inlets of turbofan engines whenever the fan blades have supersonic relative tip speeds. Results of large scale fan tests are used to illustrate the physical charateristics of this noise. A mathematical model is introduced that determines the importance of blade shock wave spacing in the noise generation process. Finally, a method of estimating the standard deviation of shock wave spacing is presented and compared with full scale data. Author

N72-25633# Technisch Physisch Dienst TNO-TH, Delft (Netherlands).
DETERMINATION OF AIRBORNE SOUND GENERATED BY THE AIR FLOW IN A SPLITTER TYPE DAMPER [BEPALING VAN DE GELUIDPRODUKTIE DOOR DE LUCHTSTROMING IN EEN COULISSENDEMPER]
P. J. M. Iping 23 Sep. 1971 8 p refs In DUTCH
(RVO-A70/KM/116; TDCK-58813; Rept-108.118/1) Avail: NTIS HC $3.00

Airborne sound generated by air flow in a splitter type damper was measured as a function of the air velocity. At an air velocity of 30 m/s, the airborne sound is stronger than expected from the extrapolation of the results at 25 m/s and below. Author

N72-25634# European Organization for Nuclear Research, Geneva (Switzerland).
MECHANISM WHICH LEADS TO THE FORMATION OF AN ELECTRIC SPARK AT VERY HIGH VOLTAGE AND UNDER ULTRA-VACUUM FOR THE MEASUREMENT OF THE DELAY TIME OF THE DISRUPTION Ph.D. Thesis - Lausanne Univ.
F. Rohrbach Oct. 1971 172 p refs In FRENCH
(CERN-71-28) Avail: AEC Depository Libraries

The measurement of the time of arc formation as a function of tension and distance between two flat disks of pure titanium was used to define the role played by two fundamental phenomena in disruptive mechanisms: field emission and the impact of charged microparticles. Photographs of the microparticles were obtained. Statistical analysis of several tens of thousands of events permitted the unification of theoretical models and showed that the various disruptive mechanisms, three in number, predominate according to certain values of the tension-distance coupling. The size of the microparticles and the emitting cathodic points were determined, based on a measure of the delay time to disruption, and good agreement was obtained for microscopic measurements by using an electron scanning microscope. Transl. by K.P.D.

N72-25635# Oak Ridge National Lab., Tenn.
AN INVENTORY OF ENERGY RESEARCH, VOLUME 1
Jan. 1972 641 p refs Prepared for NSF, Wash., D. C.
(Contract W-7405-eng-26)
(ORNL-EIS-72-18-Vol-1) Avail: NTIS

Approximately 4400 research projects are listed by title under one of 14 categories of energy sources. These categories are: fossil fuels, general; coal; petroleum; natural gas; nuclear, general; nuclear fission; nuclear fusion and plasmas; hydraulic; solar; geothermal; wind; wood and other biological; chemical; and unspecified energy sources. Each of the 14 categories of energy sources is divided into eight stages for each source, starting with exploration, continuing through mining and extraction, concentration and refining, transportation, storage, conversion, distribution, and ending with use. Each of these eight stages is, in turn, subdivided into the six following fields of research: basic research; engineering development; economic; environmental; legislative/ regulatory; and historical. NSA

N72-25636# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
GENERAL METHOD FOR COMPUTATION OF THE ACOUSTIC FIELD GENERATED BY AIRCRAFT JETS
Michel Kobrynski 1971 31 p refs In FRENCH; ENGLISH summary
(ONERA-NT-187) Avail: NTIS HC $3.75

A method was developed for computing the noise generated by standing and flying aircraft from known mathematical expressions of the sound pressure in the far acoustic field of a circular, stationary, subsonic jet. An expression representing the local sound pressure generated by stationary or mobile jets and its acoustic spectrum are determined and solved by computer. Computation was carried out for various types of aircraft and for several cases for which the mean discrepancy appeared to be of the same order within angles from - 20 deg to + 100 deg relative to the maximum emission direction. In obtuse angles relative to the jet axis there appears in flight, for fast jet, a systematic increase of the observed global noise levels, as compared to the computed ones, this discrepancy increasing with the flight Mach number. Several assumptions are proposed concerning the interaction phenomena indicated by this method. Author (ESRO)

N72-25637# Rome Univ. (Italy). Inst. of Physics.
MICROWAVE MEASUREMENT OF PERMITTIVITY AND LOSS FACTOR OF SOLIDS AND LIQUIDS BY A CAVITY PERTURBATION METHOD
A. Bonincontro and C. Cametti 18 Dec. 1971 20 p refs
(Nota-Interna-352) Avail: NTIS HC $3.00

A microwave circuit, (from 8.2 to 12.4 GHz) for the measurement of complex dielectric constants of polar liquids using the cavity perturbation method, is described. A simple relationship can be deduced by this method for the imaginary and real parts of the complex related to the change in the Q cavity factor and in the shift of the cavity resonant frequency.
ESRO

N72-25638# Rome Univ. (Italy). Inst. of Physics.
RIGOROUS THEORY OF THE BOLTZMANN EQUATION IN THE LORENTZ GAS
G. Gallavotti 10 Feb. 1972 22 p refs
(Nota-Interna-358) Avail: NTIS HC $3.25

A proof is given of the Boltzmann limit conjecture (BLC) in the case of a two-dimensional Lorentz gas with hard core W-T interactions (W, wind particles; T, tree particle) and free gas distribution of T-particles. The Boltzmann equation is an approximation of the true evolution equation, assuming that only binary collisions are considered, that molecular chaos exists at any time, and that the fact that the molecules have a non-vanishing dimension is not taken into account in the computation of the collision term. It is of interest to investigate the possibility of limiting cases in which the Boltzmann equation is rigorously true. However, the Boltzmann equation is not suitable for investigation of the long term behavior and computation of the transport coefficients.
ESRO

N72-25769*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DEGRADATION OF ALZAK BY SHORT WAVELENGTH ULTRAVIOLET RADIATION
Martin J. Donohoe, Roy McIntosh, Jr., and John H. Henninger *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 59-66 refs (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20M

N72-25432# Joint Publications Research Service, Arlington, Va.
SPIN PRECESSION EXCITATION BY MEANS OF PHASE MODULATION OF PUMPING LIGHT
V. M. Ryzhkov and L. A. Gerzha *In its* Geophys. Equipment 25 May 1972 p 7-12 refs (See N72-25430 16-14)
Avail: NTIS HC $5.75

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-25639*# Copenhagen Univ. (Denmark). Chemistry Lab.
THERMAL CONDUCTIVITY AND RESONANT MULTIPOLE INTERACTIONS
Carl Nyeland, E. A. Mason (Brown Univ.), and L. Monchick (APL) [1971] 53 p refs
(Grant NGL-40-002-059; Contract N00017-62-C-0604)
(NASA-CR-126729) Avail: NTIS HC $4.75 CSCL 20H

The influence of multipole interactions on exchanges of rotational energy in molecular collisions was investigated by means of a simple two-state impact parameter approximation. The calculations are restricted to linear molecules and to dipole and quadrupole fields. The effects of such exchanges on the thermal conductivity of gases and of gaseous mixtures was investigated, after correcting the kinetic theory of mixtures to include exchanges between unlike molecules. It was found that dipole-quadrupole and quadrupole-quadrupole interactions may have a significant effect for molecules with low moments of inertia. In particular, quadrupole interactions are important in the hydrogen isotopes, and the calculated corrections for H2 are consistent with recent experimental work by Harris. The theory seems capable of accounting for the anomalies observed in HF + DF and HCl + DCl mixtures in terms of multipolar accidental resonances.
Author

N72-25640*# California Univ., Los Angeles.
MODE COUPLING AND WAVE PARTICLE INTERACTIONS FOR UNSTABLE ION ACOUSTIC WAVES
Pablo Martin and Burton Fried, D. Feb. 1972 39 p refs
(Grants NGR-05-007-190; NGR-05-007-116)
(NASA-CR-122421; PPG-113) Avail: NTIS HC $4.00 CSCL 20H

A theory for the spatial development of linearly unstable, coupled waves is presented in which both quasi-linear and mode coupling effects are treated in a self-consistent manner. Steady state excitation of two waves is assumed at the boundary $x = 0$, the plasma being homogeneous in the y and z directions. Coupled equations are derived for the x dependence of the amplitudes of the primary waves and the secondary waves, correct through second order terms in the wave amplitude, but without usual approximation of small growth rates. This general formalism is then applied to the case of coupled ion acoustic waves driven unstable by an ion beam streaming in the direction of the x axis. If the modifications of the ion beam by the waves (quasi-linear effects) are ignored, explosive instabilities (singularities in all of the amplitudes at finite x) are found, even when all of the waves have positive energy. If these wave-particle interactions are included, the solutions are no longer singular, and all of the amplitudes have finite maxima.
Author

N72-25641# Israel Program for Scientific Translations, Ltd., Jerusalem.
RADIATION TRANSMISSION THROUGH INHOMOGENEITIES IN SHIELDS
V. G. Zolotukhin, V. A. Klimanov, O. I. Leipunskii, V. P. Mashkovich, V. K. Sakharov, B. I. Sinitsyn, and S. G. Tsypin 1971 369 p refs Transl. into ENGLISH of the Russian book "Prokhozhdenie Izluchenii Cherez Neodnorodnosti v Zashchite" Moscow, Atomizdat, 1968 p 1-362 Sponsored by AEC and NSF
(TT-70-50155; AEC-TR-7175) Avail: NTIS HC $20.50

The passage of ionizing radiation through inhomogeneities in radiation shielding is considered. Basic definitions and classifications of the inhomogeneities occurring in shields are presented, as well as data on shielding constants for calculations, and details of calculation methods and experimental techniques for investigating radiation fields in shields containing inhomogeneities. Material is included on the passage of radiation through the main types of commonly occurring inhomogeneities (empty or filled straight ducts, passing completely or partially through the shield, sectionalized bent ducts, and uniaxial and multiaxial, stepped ducts), and through shields containing distributed voids or inclusions. The perturbation introduced by linear inhomogeneities into a distributed radiation field in a medium was estimated.
Author

N72-25642# Illinois Univ., Urbana. Dept. of Physics.
A MODEL OF THE PION-POMERANCHON CUT BASED ON THE MANDELSTAM DIAGRAM
Swee-Ping Chia Apr. 1972 83 p refs
(Grant NSF GP-25303)
(ILL-(TH)-72-5) Avail: NTIS HC $6.25

The pion-Pomeranchon Regge cut was calculated from the Mandelstam diagram, using Gribov's approach. Explicit calculations are made for three representative pion exchange processes: np

yields pn, pion(-)p yields neutral rho meson n and pion (+)p yields neutral rho meson Delta hyperon (++). Pomeranchon exchange is assumed to be mediated by an isoscalar scalar sigma meson. Convergence of the loop integrals is ensured by inserting form factors to relate the off-shell pion exchange amplitudes to known on-shell behavior. Parameters in the model are the mass of the sigma meson, its coupling constants, and cut-off masses in the form factors. Author

N72-25643# Paris Univ., Orsay (France).
STUDY OF CONFIGURATION INTERACTIONS OF ATOMS OF SEVERAL INCOMPLETE ELECTRONIC LAYERS. APPLICATION AND IDENTIFICATION OF KAPPA alpha SATELLITES IN LIGHT ATOMS Ph.D. Thesis [ETUDE DE L'INTERACTION DE CONFIGURATIONS DANS DES ATOMES A PLUSIEURS COUCHES ELECTRONIQUES INCOMPLETES. APPLICATION A L'IDENTIFICATION DES SATELLITES KAPPA alpha DANS LES ATOMES LEGERS]
Alain Sureau 27 Feb. 1970 124 p refs In FRENCH
(CNRS-AO-4091) Avail: NTIS HC $8.25

The Kappa alpha satellite emission rays in light atoms and the atomic configuration of several incomplete electron layers are calculated. The relative intensities and transition positions of these phenomena are given. Transl. by E.H.W.

N72-25644# Saarland Univ., Saarbrucken (West Germany). Natural Sciences Faculty.
ELECTRON-PHONON-COUPLING IN A15-PHASES Ph.D. Thesis [ELEKTRON-PHONON-KOPPLUNG IN A15-PHASEN]
Heinz Schuster 1971 69 p refs In GERMAN
Avail: NTIS HC $5.50

A one dimensional model is used to calculate coupling of transverse acoustic phonons to d-electrons in A3B-compounds by using the wave function of an electron moving along a chain. It is shown that the electron-phonon-coupling constants for transverse acoustic phonons are larger than those for longitudinal acoustic phonons, and that the transverse acoustic coupling effect is responsible for the high thermal conductivity of Nb3Al. Transl. by G.G.

N72-25645*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRODUCTION OF I-123 Patent Application
James W. Blue, inventor (to NASA) Filed 25 Apr. 1972 9 p
(NASA-Case-LEW-11390-1; US-Patent-Appl-SN-247434) Avail: NTIS HC $3.00 CSCL 20M

A device for the production of high purity radioiodine for thyroid measurements and other medical applications is described. A cesium heat pipe is bombarded with high energy particles which cause a spallation reaction. The products of the reaction are a xenon isotope (Xe-123) and contaminants. The contaminants are removed in a dry ice cold trap. The Xe-123 condenses in a liquid nitrogen trap and is allowed to decay to radioiodine (I-123). NASA

N72-25646*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHORT-RANGE CORRELATIONS IN CARBON-12, OXYGEN-16, AND NEON-20: INTRINSIC PROPERTIES
Richard C. Braley, William F. Ford, Richard L. Becker (ORNL), and Malcolm R. Patterson (ORNL) Washington Jun. 1972 18 p refs
(NASA-TN-D-6834; E-6836) Avail: NTIS HC $3.00 CSCL 20H

The Brueckner-Hartree-Fock (BHF) method has been applied to nuclei whose intrinsic structure is nonspherical. Reaction matrix elements were calculated as functions of starting energy for the Hamada-Johnston interaction using the Pauli operator appropriate to O-16 and a shifted oscillator spectrum for virtual excited states. Binding energies, single particle energies, radii, and shape deformations of the intrinsic state, in ordinary as well as renormalized BHF, are discussed and compared with previous HF studies and with experiment when possible. Results are presented for C-12, O-16 and Ne-20. It is found that the binding energies and radii are too small, but that separation energies are well reproduced when the renormalized theory is used. Author

N72-25647*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
D AUTOIONIZATION STATES OF He AND IONIC H
A. K. Bhatia Feb. 1972 15 p refs Submitted for publication
(NASA-TM-X-65898; X-641-72-54) Avail: NTIS HC $3.00 CSCL 20H

Positions of the lowest 1,3De autoionization states of He and H(-) below the n = 2 level of the He(+) and H were calculated variationally, using Feshbach's Q-operator formalism. The trial wave function is of the Hylleraas-type with appropriate angular momentum factors. The widths and the shifts of the states have also been calculated. The shifts are found to be positive for all the states calculated here. The results with 112 terms for most states are lower than any previously calculated. The calculated lowest autoionization states of the He and H(-) (relative to the ground states of He and H respectively) are 59.902 eV and 10.1185 eV, in good agreement with the observed values of 59.9 eV and 10.13 + or-0.015 eV. Author

N72-25648*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A COMPILATION OF LABORATORY SPECTRA
J. S. Margolis 15 May 1972 4 p
(Contract NAS7-100)
(NASA-CR-126985; JPL-TM-33-541) Avail: NTIS HC $3.00 CSCL 20H

An up-to-date listing of the spectra obtained in the spectroscopy laboratory and a complete description of the experimental conditions are presented. Author

N72-25649*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF SATELLITES TO THE RESONANCE LINES IN SOME HYDROGEN-LIKE IONS Ph.D. Thesis - Colo. Univ.
Nelson Wayne Jalufka 1972 181 p refs
(NASA-TM-X-68338) Avail: NTIS HC $11.25 CSCL 20H

An experimental and theoretical investigation was conducted on the origin of satellite to resonance lines of the hydrogen-like ions of boron, carbon, and nitrogen. A theta pinch was employed with a grazing incidence spectrograph to measure the wavelengths of the satellites. The spectroscopic data also provided an estimate of the satellite/resonance line intensity ratio. Wavelengths of spectral lines due to transition from doubly excited states were calculated by a Hartree-Fock computer program. Wave functions were also calculated and were used to obtain the oscillator strengths of the transitions. Experimental work confirmed that the lines investigated were not satellites but were due to highly ionized argon which was present as an impurity in the filling gas. Author

N72-25650# Technische Universitaet, Brunswick (West Germany).
THE KINETIC ENERGY DENSITY OF A DECAYING ELECTRON GAS AS FUNCTION OF PARTICLE DENSITY IN THE PRESENCE OF A LINEAR EFFECTIVE POTENTIAL Ph.D. Thesis [DIE DICHTE DER KINETISCHEN ENERGIE EINES ENTARTETEN ELEKTRONENGASES ALS FUNKTIONAL DER TEILCHENDICHTE BEI ANWESENHEIT EINES LINEAREN EFFEKTIVEN POTENTIALS]
Ruediger Baltin 1971 178 p refs In GERMAN
Avail: NTIS HC $11.00

An improved approximation method is developed for quantum corrections to the kinetic energy function in the Thomas-Fermi theory on electron density and potential distribution in an atom. Dirac's density matrix, the density and the density

gradient are determined and density and density gradient values are transformed in convergent integers. The kinetic energy density is expressed as function of the potential and the potential gradient through a parameterization that covers the whole region between very high and very low densities.
Transl. by G.G.

N72-25651# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ANGULAR PROTON-NEUTRON CORRELATION IN THE REACTIONS C-12(d,pn) C-12 AND C-13(p,pn) C-12 Ph.D. Thesis [LA CORRELATION ANGULAIRE PROTON-NEUTRON DANS LES REACTIONS C-12(d,pn) C-12 AND C-13()p,pN) C-12]
Jean-Francois Valley 1971 43 p refs In FRENCH
(Diss-4684) Avail: NTIS HC $4.25

The mechanism of a sequential type of three-body reactions was studied, as well as the interaction of the initial and final states. Measurement of the angular distribution of disintegration products can be used to determine the tensor components of order equal to its polarization and to obtain data on the mechanism of the first state of the reaction. This technique of measurement was applied to the C-12(d,pn) C-12 reaction. It consists of verifying the hypothesis of stripping for the first state. The analysis of results in the plane wave Born approximation indicated the importance of interaction in the initial state. The angular distributions were calculated using the method of summation of diagrams. The distorted wave Born approximation confirmed that a nuclear interaction takes place in the initial state. Transl. by K.P.D.

N72-25652# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
THE SIGMA-TERM AND LOW ENERGY PION-NUCLEON SCATTERING
G. Altarelli, N. Cabibbo, and L. Maiani 1 Aug. 1971 21 p refs
(ISS-71/20) Avail: NTIS HC $3.25

A direct expression is presented for the sigma term in pion-nucleon scattering in terms of other low energy parameters. Using listed values for these quantities, the value sigma = (80 + or - 30) MeV was obtained. Author

N72-25653# State Univ. of New York, Binghamton. Dept. of Physics.
THE ENERGY-MOMENTUM RELATION FOR WEAKLY COUPLED OPTICAL POLARONS
T. M. Wu and K. Y. Yang [1972] 10 p refs
Avail: NTIS HC $3.00

The energy momentum relationship of optical polarons was investigated by taking into consideration the phonon cross exchange diagrams. The result is similar to that of the improved Tamm-Dancoff method, except that the whole curve shifts downward. Therefore, the ground state energy is lower than the upper bound obtained by the variational method. Author

N72-25654# State Univ. of New York, Binghamton. Dept. of Physics.
EFFECT OF HYDROSTATIC PRESSURE ON THE PHONON SPECTRUM OF Pb-In ALLOYS USING ELECTRON TUNNELING
H. H. Hansen, R. L. Pompi, and T. M. Wu [1972] 8 p refs
Avail: NTIS HC $3.00

The effect of hydrostatic pressure on the phonon spectrum of Pb-In alloys was studied. A shift to higher frequencies of the transverse, longitudinal and impurity band peaks was observed, as well as a reduction in amplitude. Author

N72-25655# European Atomic Energy Community, Karlsruhe (West Germany). Transuranim Inst.
STATISTICAL CALCULATION OF THE RADIATION INTENSITIES IN EMISSION SPECTROGRAPHY
W. E. Hecq and D. J. Pel 1971 32 p refs In FRENCH
(EUR-4716) Avail: AEC Depository Library; EUR FF 5.60

The two-step method using Seidel densities and interpreted statistically yields a preliminary curve consisting of two right angles whose point of intersection has a null Seidel density as ordinate. The correlation between luminous intensity emitted in a continuous current arc and the transmission of the photographic image formed was calculated by the polynomial Lagrange interpolation for each interval of 100 A wavelength. The programming scheme and simple modifications of the microphotometer are described. Transl. by K.P.D.

N72-25656# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
IMPROVEMENT OF IMPLANTERS. DEFINITION OF STRUCTURES FOR SPECIFIC APPLICATIONS
G. Guernet and J. Bernard 26 Jul. 1971 20 p refs In FRENCH Presented at 30 Intern. Symp. on the Appl. of Vacuum Tech. in Semiconductor Ind., Electron. Components, Microelectron., Versailles, France, 13 Sep. 1971
(CEA-CONF-1871; Conf-710932-2) Avail: AEC Depository Libraries

The characteristics of ion implanters designed for the fabrication of electronic components are described. The unsolved problems for implanters under construction are presented. The definition of the structure of an implanter and the necessary precisions are illustrated by an implanter designed for the development of integrated circuits with MOS transistors.
Author (NSA)

N72-25657# Paris Univ. (France).
JEANS CRITERIA AND THE FORMATION OF STARS IN THE SUPER HEAVY ANTIMATTER STAR MODEL OF OMNES M.S. Thesis
Thierry Montmerle 1971 168 p refs In FRENCH
(FRNC-TH-138) Avail: AEC Depository Libraries

The Jeans criterion was used to study the formation of stars within the nucleus of a quasar. The Omnes model (a model consisting of a superheavy star with an antimatter nucleus enveloped with ordinary matter) was used. The opacity of the medium to the thermal photons and the gamma photons produced in antimatter-matter annihilation were studied. It is shown that Thomson scattering is the dominant cause of the opacity to the thermal photons. Gamma photons are absorbed either by the Compton effect or by electron pair production. The coefficients of opacity were calculated. The gamma-photon transfer in the nucleus was studied, and the propagation velocity for a perturbation in the nucleus was calculated. The Jeans criterion was established for the conditions encountered in the medium. The Jeans length is greater by an order of magnitude than the dimensions of the nucleus, indicating that stars cannot form. NSA

N72-25658# Oak Ridge National Lab., Tenn.
AN INVENTORY OF ENERGY RESEARCH, VOLUME 2
Jan. 1972 338 p refs Prepared for NSF, Wash., D. C.
(Contract W-7405-eng-26)
(ORNL-EIS-72-18-Vol-2) Avail: NTIS

Indexes for approximately 4400 projects on energy are given. Indexes are included for: research institution; sponsoring agency; principal investigator; and permuted index of titles.
NSA

N72-25659# Howard Univ., Washington, D.C.
RADIATION DAMAGE IN OPTICALLY TRANSPARENT MATERIALS (ZIRCONS) Progress Report, 1 Feb. 1971 - 31 Jan. 1972
A. N. Thorpe, P. J. Washilewski, S. Sullivan, and F. E. Senftle 31 Jan. 1972 12 p refs
(Contract AT(40-1)-4049)
(ORO-4049-2) Avail: NTIS

Radiation damage in natural zircon caused by alpha particle

recoil of the parent uranium nucleus results in a shift of the infrared band of SiO2 from 11 to 9.7 microns, and also a decrease in the infrared transmission at 5.9 to 6.0 microns. A linear relation was found between the absorption coefficient at 5.9 to 6.0 microns and the radiation dose. After annealing at 950 C for 20 hours, the same specimens showed a smaller change in the absorption coefficient with radiation damage, indicating a partial recovery of the damaged specimens. Magnetic susceptibility studies show a linear change in susceptibility with the iron concentration. Infrared measurements indicate the ferrous iron is in octahedral coordination. Over a wide temperature range, the experimental data are in good agreement with calculated values based on a spin Hamiltonian for tetragonal geometry. The zero field splitting terms, from the spin Hamiltonian, appear to be related to the total alpha radiation dose. To further examine the damage, high voltage (1 MeV) electron microscopy is being used on very thin plates of zircon covering the entire range of alpha radiation damage. Author (NSA)

N72-25660# Oak Ridge National Lab., Tenn.
NUCLEAR WEAPONS FREE FIELD ENVIRONMENT RECOMMENDED FOR INITIAL RADIATION SHIELDING CALCULATIONS
J. A. Auxier, Z. G. Burson, R. L. French, F. F. Haywood, L. G. Mooney, and E. A. Straker Feb. 1972 50 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3396) Avail: NTIS

A review of the individual components of the initial nuclear radiation field from an intermediate yield thermonuclear weapon is presented. The purpose was to develop criteria for use in determining initial radiation protection or dose transmission factors for civil defense structures. Parameters investigated included energy and angular distributions of neutrons and gamma rays at the source, as well as those incident on the shield; transmission of neutrons and gamma rays through shielding material; triple point overpressure as a function of angle of incidence at the point of interest; and dose as a function of distance, weapon yield, and overpressure. Data are presented for the above parameters. In addition, the recommended criteria for calculating initial radiation protection or dose transmission factors are given. Author (NSA)

N72-25661# Interuniversitair Reactor Instituut, Delft (Netherlands).
GAMMA RAYS FROM ISOTOPES PRODUCED BY (n, GAMMA)-REACTIONS
M. deBruin, P. J. M. Korthoven, and N. vdDrift-Holtslag [1971] 114 p refs
(IRI-133-71-06) Avail: NTIS HC $7.75

The use of semiconductor detectors in nondestructive activation analysis requires a table of energies and relative intensities of gamma rays emitted by isotopes formed from natural elements by (n, gamma)-reactions. The gamma spectra from 0.1 to 2 MeV of the relevant isotopes were measured. In exceptional cases energies of gamma rays below 100 keV were measured as well. Energies of significant escape peaks are included in the tables but no intensities are given. Gamma rays emitted by a daughter isotope with a short half life are regarded as belonging to the spectrum of the parent isotope. The natural background spectrum composed of various components is treated as the spectrum of a single isotope. ESRO

N72-25662# Rome Univ. (Italy). Inst. of Physics.
LINE PROFILE OF THE Q01(1) VIBRATIONAL RESONANCE IN H2 IN THE ZONE OF DICKE NARROWING
F. DeMartini, G. P. Giuliani, and E. Santamato 30 Nov. 1971 13 p refs Sponsored by CNR
(Nota-Interna-349) Avail: NTIS HC $3.00

A method of high resolution nonlinear spectroscopy based on the detection of the antistokes intensity arising from a resonant four-photon coherent interaction is applied to the determination of the line profile of the Raman resonance in hydrogen gas. The real part, as well as the imaginary part, of the nonlinear Raman susceptibility was observed in a thermodynamical condition for the gas in which the Dicke-narrowing process and the dephasing collision-broadening effect determine competitively the shape of the resonance line. Author (ESRO)

N72-25663# Rome Univ. (Italy). Inst. of Physics.
IMPLICATIONS OF GAUGE-INVARIANCE FOR PION ELECTROPRODUCTION AT THRESHOLD
G. Benfatto, F. Nicolo, and G. C. Rossi 15 Jan. 1972 29 p refs
(Nota-Interna-354) Avail: NTIS HC $3.50

The implications of gage invariance are discussed in the problem of the on-shell extrapolation of the electroproduction low-energy theorems. It is shown that there is an invariant amplitude which can be evaluated at the Breit threshold either using gage invariance and on shell dispersion relations or following the Fubini and Furlan extrapolation method starting from the current algebra low-energy value of the amplitude. Comparing the two expressions, a relation is found between the electromagnetic pion form factor and the axial vector nucleon form factors. Author (ESRO)

N72-25664# Rome Univ. (Italy). Inst. of Physics.
EPSILON PRODUCTION IN A GEOMETRICAL APPROACH
C. A. Garcia Canal, C. Ferro Fontan (Buenos Aires Univ.), and G. Violini (La Plata Univ.) 9 Feb. 1972 8 p refs Sponsored in part by Consejo Nacl. de Invest. Cient. y Tec. de la Rep. Arg. and Fondazione Angelo della Riccia
(Nota-Interna-357) Avail: NTIS HC $3.00

Epsilon production is analyzed by making use of pion exchange dual predictions in agreement with experimental data based on a proposal suggested by Hakari. According to this proposal, the behavior as a function of time of the imaginary part of the S-channel helicity amplitude is given, for a fixed value of the energy, by a Bessel function, which includes the interaction radius and the amount of helicity flip in that channel. The analysis shows that it may be possible to apply the Hakari model to the quantitative determination of S-channel amplitudes. ESRO

N72-25665# Rome Univ. (Italy). Inst. of Physics.
ELEMENTARY PION WITH TRANSVERSE MOMENTUM CUT OFF FOR INCLUSIVE PROCESSES
M. Lusignoli and Y. Srivastava 21 Feb. 1972 11 p refs Sponsored in part by NSF
(Nota-Interna-360) Avail: NTIS HC $3.00

The pion contribution to the neutron spectra in high energy reactions of the type a + proton yields neutron + anything, is analyzed, under the hypothesis that the pion is elementary, and a transverse momentum cutoff exists. It is found that the pion contribution can be absolutely related to the pion- a cross section and previously determined parameters. Two-particle spectra of the type p + p yields n + n + anything are derived and commented upon. ESRO

N72-25666# Melbourne Univ., Parkville (Australia). School of Physics.
[PHOTONEUTRON AND PHOTOPROTON SPECTRA] Final Report
B. M. Spicer 24 Jan. 1972 9 p
(Grant DAHC19-70-G-0026)
(AD-738005) Avail: NTIS CSCL 20/8

The following are discussed: Precision measurements of gamma cross sections; Photoproton energy and angular distributions; and Photoneutron spectra from light nuclei. GRA

N72-25667# Zaragoza Univ. (Spain). Dept. of Physics.
CONTRIBUTION TO THE STUDY OF UNSTEADY STATES IN THERMAL DIFFUSION COLUMNS Ph.D. Thesis [CONTRIBUCION AL ESTUDIO DE ESTADOS NO ESTACIONARIOS EN COLUMNAS DE DIFUSION

TERMICA]
Maria Dolores Mendia Iturbe May 1970 120 p refs In SPANISH Sponsored jointly by CSIC and ESRO
Avail: NTIS HC $8.00

A hot-wire type thermal diffusion column with lower variable dead volume is used to study the general formulation of approach to equilibrium in multicomponent isotopical mixtures. A new method to solve the equations of approach to equilibrium is proposed based on a new formulation in function of the separation factor. Both cases of ideal and non-ideal columns are treated and the analysis shows that the separation reached at any time does not depend on the initial concentration. Agreement between theory and experiment is found. The interpretation of all the experimental data with a unique set of transport coefficients H sub O, Kc and Kd is possible. Author (ESRO)

N72-25770*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT RADIATION ANALYSIS
Dale W. Harris *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 67-70 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 18D

N72-25786*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION DAMAGE EFFECTS ON SOLID STATE DETECTORS
James H. Trainor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 129-132 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 18H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-25668*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROBE MEASUREMENTS OF A CESIUM PLASMA IN A SIMULATED THERMIONIC ENERGY CONVERTER
K. Shimada 15 May 1972 15 p refs
(Contract NAS7-100)
(NASA-CR-126866; JPL-TM-33-551) Avail: NTIS HC $3.00 CSCL 20I

Cesium-filled thermionic energy converters are considered as electrical energy sources in future spacecraft requiring tens to hundreds of kilowatts of electric power. The high operating temperatures necessary for a large specific power and high efficiency impose stringent constraints on the converter fabrication. The converter physics for reducing operating temperatures and cesium plasma losses are being studied to achieve high reliability without sacrificing the power performance of the converters. Various cesium parameters which affect the converter performance are: (1) electron temperatures, (2) plasma ion densities, and (3) electric potential profiles. These were investigated using a Langmuir probe in a simulated converter. The parameters were measured in different cesium discharge modes. Author

N72-25669# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
PLASMA DIAGNOSTICS USING A MONOENERGETIC POTASSIUM BEAM Ph.D. Thesis - Paris Univ, France
Michel Nicolas Sep. 1971 93 p refs In FRENCH
(EUR-CEA-FC-615) Avail: AEC Depository Libraries

Measurements of the transparency of a plasma to a neutral beam enabled its density to be deduced. A source providing a beam of single-energy K atoms (0.5 to 2 keV) was developed. After the emergent beam is ionized by oxygen, the K ions having crossed an electrostatic analyzer (resolution 5 percent) are deflected by a secondary emission assembly and produce photoscintillations. The very short detector response time means that only the K atom transit times in the plasma limit the temporal resolution of the assembly. Measurements of the surface plasma density of the DECA 2B machine and changes in this density with time were carried out with this source detector assembly. The values obtained are in good agreement with those obtained using microwave interferometry. Author (NSA)

N72-25670# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'etudes Nucleaires.
PROCESSES INVOLVED IN IMPURITY IONIZATION IN HOT PLASMAS
S. Bliman Nov. 1971 16 p refs In FRENCH; In FRENCH; ENGLISH summary Sponsored by EURATOM
(EUR-CEA-FC-624) Avail: AEC Depository Libraries

Collisions producing multiply charged heavy ions are examined, specifically, successive and shake-off ionization for impurities in hot plasmas. NSA

N72-25671# Wisconsin Univ., Madison. Dept. of Electrical Engineering.
PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Quarterly Progress Report
J. L. Shohet 15 Sep. 1971 32 p refs
(Contract AT(11-1)-1695)
(COO-1695-39; QPR-18) Avail: NTIS

The work covered three areas: (1) polarization measurements of the free-free bremsstrahlung X-rays; (2) optical diagnostics; and (3) microwave calculations. The bremsstrahlung measurements were made to determine the polarization distribution of the free-free bremsstrahlung exiting radially along the midplane as a function of various plasma parameters. They are: pressure, magnet current, mirror ratio and offresonance power, as well as axial displacement of both the heating and observing location. Optical measurements of intensity ratios were made to determine the effects of plasma parameters on neutral and ion temperatures. Progress on microwave cavity calculations for a warm plasma was made. Author (NSA)

N72-25672# Princeton Univ., N.J. Plasma Physics Lab.
COMMENTS ON PARTICLE SIMULATION OF PLASMAS
John M. Dawson [1971] 10 p refs
(Contracts AT(30-l)-1238; N00014-67-A-0151-0021)
(TID-25912) Avail: NTIS

Computer simulation, of plasmas using particle models is reviewed. The different techniques combined with present computers are discussed. NSA

N72-25673# Los Alamos Scientific Lab., N.Mex.
COLLECTIVE INTERACTIONS AND ELECTRICAL CONDUCTIVITY OF A PLASMA IN STRONG ELECTRICAL FIELDS
V. A. Suprunenko, E. A. Sukhomlin, and V. T. Tolok Nov. 1971 25 p refs Transl. into ENGLISH from Russian report KHFTI-70-67 Sponsored by AEC
(LA-tr-71-79; KHFTI-70-67) Avail: NTIS

It is shown that the electrical conductivity of a plasma for small electric fields is a complex function of the electric field, the form of which depends on the type of magnetic trap. The main physical mechanism determining the anomaly of the resistance is the current instabilities and, above all, the ion sound instability. For large electric fields the measured electric conductivity of a plasma is proportional to the square root of (N) and does not depend on the strength of the electric field and the temperature of the plasma. The dynamics of current instabilities in a discharge are investigated, and their importance in the process of the development of a gaseous discharge is explained. The experimental values of the electrical conductivity of a plasma are found to be in good quantitative agreement with theory.
Author (NSA)

N72-25674# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ELECTRIC POTENTIAL MEASUREMENTS BY ION BEAM PROBING
Rolf B. Johansson Feb. 1972 41 p refs
(TRITA-EPP-71-26) Avail: NTIS HC $4.25

Ion beam probing of an electric potential distribution, in a dilute plasma, by the time of flight at different ion energies is studied. Both reflected and transmitted ions are considered. Simple monotonic potentials can be probed accurately by reflected ions. With proper precautions, maxima can be localized and partial information obtained about potential valleys. Transmitted ions are easier to measure than reflected ions but give less information. Detailed numerical procedures are given to extract the maximum amount of information from time of flight measurements. The effect of superimposed electric field fluctuations are briefly discussed. Author (ESRO)

N72-25675# European Space Research Inst., Frascati (Italy).
KELVIN HELMHOLTZ INSTABILITY IN A HIGH BETA COLLISIONLESS PLASMA
Marino Dobrowolny [1972] 34 p refs
Avail: NTIS HC $3.75

Stability was investigated for an inhomogeneous plasma arbitrary beta, (i.e. the ratio of particle kinetic pressure to magnetic pressure), flowing along a straight magnetic field. Both the velocity flow and the plasma density vary spatially in a direction perpendicular to the field. For drift-type waves, elongated in the magnetic field direction, an Alfven wave branch and a magnetosonic branch were found to be decoupled. It was found that both branches may be made unstable by the velocity shear. Stability conditions are worked out, quantitatively discussed and compared in terms of beta and magnitude of the shear.
Author (ESRO)

N72-25676# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
LITERATURE SURVEY ON PLASMA INSTABILITIES. VOLUME 2: ABSTRACTS, PART C
Gerhard Auer, Ferdinand Cap, Dietmar Floriani, and Herbert Gratzl 15 Aug. 1971 211 p refs
(Contract F61052-70-C-0014)
(AD-738218; UNICP-SR83-Vol-2-Pt-C) Avail: NTIS CSCL 20/9

Vol. 1 gives single reports surveying plasma instabilities. It contains 121 single reports and a subject index (list of instabilities) enabling the reader to find the survey report on a special instability. Vol. 2 consists of several parts and contains all abstracts made. An index at the end of Volume 2 enables one to find all abstracts belonging to a specified instability. GRA

N72-25677# Systems Research Labs., Inc., Dayton, Ohio.
DESIGN, DEVELOPMENT, AND APPLICATION OF A COMPLETE ANALOG PLASMA-DIAGNOSTIC SYSTEM
Daniel R. Nordlund and Onezime P. Breaux (AF Avionics Lab.) Wright-Patterson AFB, Ohio AFAL Sep. 1971 25 p refs
(Contract F33615-68-C-1398; AF Proj. 4152)
(AD-738306; AFAL-TR-71-294) Avail: NTIS CSCL 20/9

The simple electronic diagnostic system described provides a calibrated oscilloscope display of a Langmuir-probe I-V characteristic, its first- and second-derivative curves, the electron-energy distribution function, and the cumulative electron number density. The system also provides a simple method for determining plasma potential and--if it exists--the electron temperature. Data taken in a low-temperature mercury discharge is compared with data taken by means of the well-known harmonic second-derivative technique. An electron number density of 4.9 x 10 to the 16th power/cubic meter and an electron temperature of 9,700 K found with the new system compare very favorably to values of 4.7 x 10 to the 16th power/cubic meter and 9900 K determined from the harmonic second-derivative data. The system described features more rapid data reduction and lower cost than existing harmonic systems. A detailed design procedure for construction of the accurate differentiators is given. Author (GRA)

N72-25678# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
SUMMARY OF AIR FORCE EXPLORATORY DEVELOPMENT EFFORTS IN HIGH POWER ILLUMINATION SOURCE
Ellsworth L. Boyer and Edward T. Mahefkey Nov. 1971 42 p refs
(AF Proj. 3145)
(AD-737832; AFAPL-TR-71-60) Avail: NTIS CSCL 13/1

The development of high power (100-500 kilowatt electric, kWe) illumination sources for military airborne applications is described. Lamp classifications, physical characteristics of lamps, and expected overall system efficiencies are discussed. Results of exploratory testing on vortex stabilized arc lamps in the 100-500 kWe range and a long arc, electrode stabilized lamp in the 100-120 kWe range are reviewed. It was shown that at these power levels the vortex arcs have a luminous efficiency of more than 40 lumens per electrical watt and lifetimes of at least 12 hours. Difficulties in anode cooling and quartz envelope contamination were encountered. Experimental results showed that compact, lightweight lamp modules were practical in the 150-200 kWe range. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-25679* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
***GUNN-TYPE SOLID STATE DEVICES* Patent**
Wilhelm Rindner and Harold Roth, inventors (to NASA) Issued 30 May 1972 6 p Filed 6 Jul. 1967
(NASA-Case-XER-07895; US-Patent-3,667,010; US-Patent-Appl-SN-651627; US-Patent-Class-317-235R; US-Patent-Class-317-235A; US-Patent-Class-317-234J; US-Patent-Class-317-235AJ; US-Patent-Class-331-107G) Avail: US Patent Office CSCL 20L

A multiterminal Gunn-type semiconductor microwave generator capable of producing signals of stable frequency over a frequency range is described. In one form, a group III-V semiconductor chip having a varying cross-sectional area is mounted between a pair of contacts. The inner portion of the chip is doped to create a region of one type of conductivity, and an outer shell portion of the chip is doped to create a region of opposite or different conductivity with a junction formed between the regions. A potential is applied across the pair of contacts to create an electric field gradient along the current axis of the device. A bias is applied through a third contact to the junction, which for the sake of discussion will be referred to as a p/n junction. The biased p/n junction creates a space-charge region that controls the length of the active region. The third terminal controls the frequency of the signal generated by the overall device. Official Gazette of the U.S. Patent Office

N72-25680* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRICITY MEASUREMENT DEVICES EMPLOYING LIQUID CRYSTALLINE MATERIALS Patent
Andre Garfein, Wilhelm Rindner, and David C. Rubin, inventors (to NASA) Issued 30 May 1972 6 p Filed 17 Jun. 1970 Supersedes N70-40022 (08 - 22, p 4203)
(NASA-Case-ERC-10275; US-Patent-3,667,039; US-Patent-Appl-SN-47061; US-Patent-Class-324-92; US-Patent-Class-324-96; US-Patent-Class-350-150; US-Patent-Class-350-160R; US-Patent-Class-340-324R) Avail: US Patent Office CSCL 09E

Measuring instruments are described which utilize liquid crystalline elements that exhibit visible change in response to input signals above given threshold levels. By applying the input signals nonuniformly so that the threshold value is exceeded in only certain portions of the liquid crystalline element, visible discontinuities are created therein. The locations of these discontinuities are made dependent on the magnitudes of the input signals, direct readouts of which are provided by suitably calibrated indicia. Official Gazette of the U.S. Patent Office

N72-25681 Waterloo Univ. (Ontario). Solid Mechanics Div.
MECHANICAL BEHAVIOUR OF POLYCRYSTALS AT ELEVATED TEMPERATURES
D. M. R. Taplin, P. Rama Rao, and V. V. P. K. Rao Mar. 1972 49 p refs Submitted for publication
(Rept-108) Avail: Issuing Activity

The mechanical behavior of metals and alloys during high temperature deformation (creep, superplasticity, hot working and high temperature fatigue) is reviewed. The influence of temperature, rate of deformation, and grain size on the strength and ductility are discussed. Mechanical behavior of polycrystalline metals at temperatures above about half the absolute melting temperature is characterized by thermally activated deformation and recovery processes. These processes include diffusional creep, grain boundary sliding and migration, dislocation climb, dynamic recrystallisation, and grain boundary cavitation. The role of each of these processes during creep, superplasticity, hot working and fatigue are outlined. Author

N72-25682*# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
PROXIMITY EFFECT BETWEEN SUPERCONDUCTIVITY AND NORMAL METALS Semiannual Report
Hans Meissner Apr. 1972 18 p refs
(Grant NGL-31-003-020)
(NASA-CR-126771; SIT-P268) Avail: NTIS HC $3.00 CSCL 20L

The SNS junctions were limited to having gold (n) layers of less than 3000 A in order to avoid having the tin (S) films become normal under the influence of the signal current in the gold. The gold layer was alloyed with 10 wt% copper to shorten its electronic mean free path, increasing the tin layer critical current while decreasing the Josephson critical current. It was also found that a previously reported anomalous voltage shift in the presence of I2 is caused by the tin being driven normal. After deposition, the samples were transferred to a conventional cryostat to provide better thermal contact to the films. This reduction of heating in the films produced more linear I-V characteristics and a change in the constant voltage current gain. In order to achieve power gain, the SNS device must be operated at lower temperatures where the effects of fluctuations are less and be constructed such that the input resistance is much reduced and the dynamic output resistance increased. A geometry is proposed using a more sophisticated evaporator. Author

N72-25683*# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
NIOBIUM HYPERFINE STRUCTURE IN CRYSTAL CALCIUM TUNGSTATE Final Report
Der Ling Tseng and Chihiro Kikuchi Apr. 1972 204 p refs
Sponsored in part by the Andrew A. Kucher Scholarship in Nucl. Eng.; Natl. Tsing Hua Univ., Taiwan, China; and the Agency for Intern. Develop., Washington, D. C.
(Grant NGR-23-005-004; ORA Proj. 043810)
(NASA-CR-126751; Rept-043810-F) Avail: NTIS CSCL 20B

A study of the niobium hyperfine structure in single crystal calcium tungstate was made by the combination of the technique of electron paramagnetic resonance and electron nuclear double resonance (EPR/ENDOR). The microwave frequency was about 9.4 GHz and the radio frequency from 20 MHz to 70 MHz. The rare earth ions Nd(3+), U(3+), or Tm(3+) were added as the charge compensator for Nb(5+). To create niobium paramagnetic centers, the sample was irradiated at 77 deg K with a 10 thousand curie Co-60 gamma source for 1 to 2 hours at a dose rate of 200 K rads per hour and then transferred quickly into the cavity. In a general direction of magnetic field, the spectra showed 4 sets of 10 main lines corresponding to 4 nonequivalent sites of niobium with I = 9/2. These 4 sets of lines coalesced into 2 sets of 10 in the ab-plane and into a single set of 10 along the c-axis. This symmetry suggested that the tungsten ions are substituted by the niobium ions in the crystal. Author

N72-25684# Technische Hogeschool, Eindhoven (Netherlands).
AVALANCHE AND MICROWAVE EMISSION IN N-TYPE INDIUM ANTIMONIDE AT LIQUID NITROGEN TEMPERATURE
Robert Gerrit vanWelzenis 1 Feb. 1972 164 p refs Mostly in ENGLISH; partly in DUTCH
Avail: NTIS HC $10.25

An attempt was made to understand the avalanche process and establish the numerical value of the parameters. Data cover properties of material, in InSb, high field transport, potential distribution, and microwave emission. E.H.W.

N72-25685# Paris Univ. (France). Faculte des Sciences.
INFRARED SPECTROSCOPIC STUDY OF RESIDUE VIBRATIONS OF AlO3La, AlO3Pr, AND AlO3Nd COMPOUNDS Ph.D. Thesis [ETUDE PAR SPECTROSCOPIE I.R. DES VIBRATIONS DE RESEAU DES COMPOSES AlO3La, AlO3Pr, AlO3Nd]
Pierre Alain 20 Mar. 1970 75 p refs In FRENCH
Avail: NTIS HC $5.75

The dynamic crystalline lattice of aluminum compounds and their vibrational interactions with electromagnetic fields are examined. A description of the equipment, analysis of spectral reflectance by the inverse relations of Kramer-Kronig, and the classical determination of oscillation parameters are included. A theoretical evaluation of the number of active infrared and Raman modes in two spatial groups and a critical comparison with experimental results are outlined. Transl. by E.H.W.

N72-25686# Saarland Univ., Saarbrucken (West Germany). Mathematisch-Naturwissenschaftlichen Fakultaet.
VELOCITY OF SOUND, LATTICE INSTABILITY, AND MAGNETIC SUSCEPTIBILITY IN A15 PHASES Ph.D. Thesis [SCHALLGESCHWINDIGKEIT, GITTERINSTABILITAET UND MAGNETISCHE SUSZEPTIBILITAET IN A15-PHASEN]
Wolfgang Dieterich 1971 85 p refs In GERMAN
Avail: NTIS HC $6.25

Intermetallic compounds of type A15 structure in the superconducting condition are analyzed by a microscopic theory of cubic-tetragonal lattice transformation in the A15-phase and its characteristic chain structure. The lattice dynamic is formulated in a two-band model. Wave functions are used to analyze a-electrons located on the chains and sound velocity is determined by a- and b-densities and atomic parameters. Special properties of the A15 structure produce the following results: (1) renormalization of phonon frequencies is anisotropic; (2) transverse phonons couple with electrons about as strongly as with longitudinal phonons; (3) transverse phonon frequency oscillation normalizes readily as observed in the soft mode; and (4) increased localization of a-electrons increases also a-electron to phonon coupling as seen in frequency normalization. It is also shown that electric constants and magnetic permeabilities in the V3Si and Nb3Sn systems are temperature dependent.
Transl. by G.G.

N72-25687*# Translation Consultants, Ltd., Arlington, Va.
CRYSTAL STRUCTURE OF OLIVINE
Y. Kuroda and I. Matsuhisa Washington NASA May 1972 17 p refs Transl. into ENGLISH from Akad. Nauk SSR Siberskoe Otdel., Inst. Geol. i Geofiz. (USSR), v. 2, 1970 p 169-180

(Contract NASw-2038)
(NASA-TT-F-14243) Avail: NTIS HC $3.00 CSCL 20B

The well-developed olivine cleavages parallel to (100), (010), and (001) show a strong intensity of 020, reflecting its crystal structure. On the basis of the intensity of 020, olivine is divided into three groups: (1) olivine with cleavage, (2) common olivine, and (3) olivine synthesized at atmospheric pressure. Primary dunite, consisting of the cleavable olivine, is recrystallized into metamorphosed dunite consisting of common olivine. Cleavable olivine was heated at above 1400 C of atmospheric pressure and its 020 intensity became as weak as that of common olivine. Further heating of cleavable olivine to 1700 C makes it as weak as that of olivine synthesized at atmospheric pressure. Olivine synthesized from oxides at high pressure and temperature (44 to 72 kb, 1600 C) shows a different type of intensity relation from that of the above-mentioned olivines. The probability of polymorphic change in the crystal structure of olivine is suggested. Author

N72-25688*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROPERTIES OF CONDUCTIVE THICK-FILM INKS
R. F. Holtze 15 Apr. 1972 50 p
(Contract NAS7-100)
(NASA-CR-126973; JPL-TM-33-532) Avail: NTIS HC $4.50 CSCL 20L

Ten different conductive inks used in the fabrication of thick-film circuits were evaluated for their physical and handling properties. Viscosity, solid contents, and spectrographic analysis of the unfired inks were determined. Inks were screened on ceramic substrates and fired for varying times at specified temperatures. Selected substrates were given additional firings to simulate the heat exposure received if thick-film resistors were to be added to the same substrate. Data are presented covering the (1) printing characteristics, (2) solderability using Sn-63 and also a 4 percent silver solder, (3) leach resistance, (4) solder adhesion, and (5) wire bonding properties. Results obtained using different firing schedules were compared. A comparison was made between the various inks showing general results obtained for each ink. The changes in firing time or the application of a simulated resistor firing had little effect on the properties of most inks. Author

N72-25689# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ULTRAVIOLET AND ZEEMAN EFFECT STUDIES ON IRON TITANIUM SAPPHIRE Ph.D. Thesis [ULTRAVIOLETT- UND ZEEMANEFFEKT-UNTERSUCHUNGEN AN EISEN-TITANSAPHIR]
Karl Heinrich Kurtz 1971 76 p refs In GERMAN
(Diss-4600) Avail: NTIS HC $6.00

Some relatively narrow bands in the near ultraviolet spectrum of Fe(3±) ions of an alpha corundum matrix were studied at 4 K. Line shape analysis established the parameters of six weak, polarized lines; however, with the applied magnetic field of 12 kG a significant Zeeman effect was not observed. Measurements at liquid helium and nitrogen temperatures gave the same results. Transl. by G.G.

N72-25690# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THE OPTIMAL DIMENSIONS OF ELECTRICAL SUPERCONDUCTORS FOR CRYOGENIC SYSTEMS Ph.D. Thesis [DIE OPTIMALEN DIMENSIONEN ELEKTRISCHER ZULEITUNGEN FUER TIEFTEMPERATURANLAGEN]
Markus Rauh 1971 152 p refs In GERMAN
(Diss-4656) Avail: NTIS HC $9.75

Differential equations for electric current conduction to low temperature system are used to develop optimal criteria and characteristic values of heat transfer between gas and conductor. A solution for the stabilization of periodic current carrying conductors is proposed and the possibility of temperature profile instability is discussed. The effects of residual resistance, cooling intensity, current density, and extreme conductor temperatures on thermal loss, optical dimensions, and electric potential are analyzed quantitatively for copper. A comparison of copper results with results from other conductor materials shows that thermal losses can be predicted by simple approximations of the first order. However, only numerical calculations produce valid conductor dimensions. Transl. by G.G.

N72-25691# Aeronautical Research Labs., Melbourne (Australia).
THE LATTICE DIMENSIONS OF THE AB2 LAVES PHASES
A. R. Edwards Sep. 1971 25 p refs
(ARL/Met-86) Avail: NTIS HC $3.25

A combined geometric/chemical model is proposed to account for the observed lattice dimensions of the cubic AB2 laves phases. These compounds are treated as a hybrid structure between the simple metallic bcc and fcc structures, the interatomic spacings depending on the atomic diameters of the pure A and B metals and on the difference in their electronegativities. The model indicates that the electronegativity concept could find wider quantitative applications in alloy chemistry. The treatment leads to qualitative explanations for the relative frequency of occurrence of cubic and hexagonal laves phases, the incidence of allotropy in these compounds, the nonappearance of laves phases in certain apparently favorable alloy systems, and the minimum A-metal content found in phases showing a range of homogeneity. Author

N72-25692# Joint Publications Research Service, Arlington, Va.
PRODUCTION OF METALLIC HYDROGEN
L. F. Vereshchagin and R. G. Arkhipov 30 May 1972 10 p Transl. into ENGLISH from Priroda (Moscow), no. 3, Mar. 1972 p 9-12
(JPRS-56130) Avail: NTIS HC $3.00

Predicted properties of metallic hydrogen are discussed. Ways of attaining the colossal pressures required to keep hydrogen in the metallic state at room temperature are examined. Author

N72-25693*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY TERRESTRIAL BASED EXPERIMENTS ON GRAVITY-AFFECTED CRYSTAL GROWTH
Mary Helen Johnston 13 Mar. 1970 19 p refs
(NASA-TM-X-53999) Avail: NTIS HC $3.00 CSCL 20B

Tin was melted in a heating assembly secured to the arm of a centrifuge. The furnace was allowed to pivot and reach its equilibrium angle of swing for the gravity force being experienced. The crucible was cooled during rotation to allow the growth of single crystals. The crystals were etched for the purpose of observing the growth striations. Slices were removed from some of the crystals to permit observation of the striations in the interior. Visual analyses were made with a scanning electron microscope. Preliminary conclusions relating the appearance of the striations to gravity forces and the affected growth mechanisms are presented. Further experiments that will verify these conclusions and determine other gravity effects are proposed. Author

N72-25694# Georgetown Univ., Washington, D.C.
A STUDY OF SUPERCONDUCTIVITY IN FAST FROZEN (SPLAT-COOLED) INDIUM-GALLIUM ALLOYS (INCLUDING A CRITICAL ANALYSIS OF THE AC SUSCEPTIBILITY FOR STUDYING NORMAL PROPERTIES OF METALS Ph.D. Thesis
Paul J. Carroll Jun. 1971 228 p refs Sponsored by AEC
(TID-25864) Avail: NTIS

The measurements indicate that, above 0.25% In, a small volume of the sample becomes superconducting near T sub c of indium (3.4 K), but bulk superconductivity does not occur until T = T sub c of gallium (1.08 K). Microprobe analysis measurements show that the indium and gallium are homogeneously distributed with the indium in clumps less than a

micron in size and separated by an average distance less than one micron. Several models of superconductivity for the In-Ga system were analyzed, using the superconductivity data. All of the models fit some features of the data, but only the model of an array of small superconducting In-Ga loops with gallium enhanced by a proximity effect is consistent with all the measurements. However, the agreement for the proximity-effect model is not strong enough to consider the model as unique. The resistive-component behavior of In-Ga and pure single-crystal gallium samples in ac magnetic fields was also studied.
Author (NSA)

N72-25695# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimental Kernphysik.
SIMPLIFIED THEORY FOR RESIDUAL FIELD GENERATED BY SUPERCONDUCTING DIPOLES AND QUADRUPOLES WITH UNSATURATED IRON SHIELDS
Michael A. Green Sep. 1971 23 p refs
(KFK-EXT-3/71-10) Avail: AEC Depository Libraries

The development of the theory for residual fields generated within superconducting dipole and quadrupole magnets is discussed in detail. These residual fields are caused by circulating currents in the individual filaments of the twisted composite superconductor used to build superconducting magnets. The theory is extended to the case where an unsaturated iron shield surrounds the dipole or quadrupole. The theory is applicable for calculating the two dimensional residual field and its multipoles. The effects of residual fields on magnetic field uniformity and the effect of the residual field on synchrotron design are discussed.
NSA

N72-25696# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
APPLICATION OF SUPERCONDUCTIVITY IN THERMONUCLEAR FUSION RESEARCH
A. P. Martinelli Oct. 1971 23 p refs Presented at the Summer Course, The Sci. and Tech. of Superconductivity, Washington, 13-26 Aug. 1971
(IPP-4/91) Avail: AEC Depository Libraries

Recent technological developments of high field superconducting materials and cryogenic, adiabatic, and dynamic stabilization methods are examined. Two experiments are described, the 6 quadrupole and the 7 stellarator, which are being constructed and planned.
Author (NSA)

N72-25697# National Physical Lab., Teddington (England). Div. of Chemical Standards.
A TENTATIVE ANALYSIS OF THE BOND TYPES IN BINARY METALLURGICAL SYSTEMS
O. Kubaschewski and W. Slough Mar. 1972 30 p refs
(NPL-DCS-15) Avail: NTIS HC $3.50

Data cover crystallographic structure, electron density distribution in solid elements, X-ray analysis of liquid metallic solutions, heats and excess entropies of formation, volume changes, electrolytic transport measurements, electrical conductivity, magnetic susceptibilities, and Mossbauer spectroscopy. The results are given in tabular form.
ESRO

N72-25698# Illinois Univ., Urbana. Coordinated Science Lab.
LUMINESCENCE OF CdSe AND CdS AND THE INFLUENCE OF DEFECTS Ph.D. Thesis
Brij Mohan Arora Jan. 1972 182 p refs
(Contracts DAAB07-67-C-0199; F33615-69-C-1251)
(AD-737910; R-550; UILU-ENG-72-2209) Avail: NTIS CSCL 20/12

Spontaneous luminescence of pure CdSe and CdS at low temperature, excited by mercury lamp, shows a number of peaks attributed to bound exciton and free exciton recombination mechanisms. Temperature dependence (6K to 80K) of various emission lines has been determined to characterize the transition mechanisms responsible for them. Stimulated emission of a number of CdSe platelets has been studied as a function of exciton intensity and temperature by using Ga(As,P) pulsed laser diode as pump. These results indicate that there is no unique origin of the stimulated emission at low temperatures. A number of transition mechanisms, involving free and bound excitons, simultaneously compete and generate stimulated emission dependent on the level of excitation and the platelet being excited. Several of the stimulated peaks appear to be correlated to the spontaneous lines resulting from bound exciton transitions accompanied by emission of an LO phonon.
Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-25699* Rocketdyne, Canoga Park, Calif.
HYDRAZINIUM NITROFORMATE PROPELLANT STABILIZED WITH NITROGUANIDINE Patent
Vernon E. Haury, inventor (to NASA) Issued 25 Apr. 1972 3 p Filed 23 Sep. 1970 Supersedes N72-13736 (10 - 04, p 531)
Sponsored by NASA
(NASA-Case-NPO-12000; US-Patent-3,658,608; US-Patent-Appl-SN-74861; US-Patent-Class-149-19; US-Patent-Class-149-20; US-Patent-Class-149-36; US-Patent-Class-149-92) Avail: US Patent Office CSCL 21I

The stability of solid propellant compositions containing unsaturated carboxyl-terminated hydrocarbon binders and hydrazinium nitroformate as an oxidizer will have improved shelf life and stability through the incorporation of nitroguanidine in the mixture.
Official Gazette of the U.S. Patent Office

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-25700*# Aerojet Liquid Rocket Co., Sacramento, Calif.
REPORT, STATUS, MASS PROPERTIES FOR PHASE A/B STUDY FOR A PRESSURE FED ENGINE ON A REUSABLE SPACE SHUTTLE BOOSTER
15 Mar. 1972 26 p
(Contract NAS8-28217)
(NASA-CR-123638; MSFC-SE-019-014-2H; Rept-9755-72-5)
Avail: NTIS HC $3.50 CSCL 21H

The engine weight, mass properties data, and engine design criteria and specifications are presented for a 1.2 million lb sea-level thrust pressure-fed LOX/RP-1 engine. Engine trade study weight data are included.
Author

N72-25701*# Aerojet Liquid Rocket Co., Sacramento, Calif.
DESIGN DATA BOOK PHASE A/B STUDY FOR A PRESSURE-FED ENGINE ON A REUSABLE SPACE SHUTTLE BOOSTER
15 Mar. 1972 63 p refs
(Contract NAS8-28217)
(NASA-CR-123639; MSFC-SE-019-010-2H; Rept-9755-72-3)
Avail: NTIS HC $5.25 CSCL 21H

Preliminary engineering definition information is presented for a liquid pressure-fed reusable booster engine. The material is reported in three separate sections which include: (1) program

and baseline data, (2) critical trade studies summary, and (3) methodology. Author

N72-25702*# General Applied Science Labs., Inc., Westbury, N.Y.
RESEARCH ON TURBOJET COMBUSTOR POLLUTANT FORMATION Quarterly Progress Report, 15 Jan. - 15 Apr. 1972
15 Apr. 1972 32 p refs
(Contract NASw-2235)
(NASA-CR-126724; QPR-3-5865) Avail: NTIS HC $3.75 CSCL 21E

The research for developing a modular computer program for describing gas-turbine combustor flow and chemical fields is reported. The status of investigations is presented for three key elements of the unified model: turbulent mixing with swirl, turbulent mixing with swirl including finite-rate kinetics, and multiphase recirculation zone analysis F.O.S.

N72-25703*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPLETELY MODULAR THERMIONIC REACTOR ION PROPULSION SYSTEM (TRIPS)
M. L. Peelgren, G. M. Kikin, and C. D. Sawyer 15 May 1972 22 p refs
(Contract NAS7-100)
(NASA-CR-126865; JPL-TM-33-550) Avail: NTIS HC $3.25 CSCL 21C

The nuclear reactor powered ion propulsion system described is an advanced completely modularized system which lends itself to development of prototype and/or flight type components without the need for complete system tests until late in the development program. This modularity is achieved in all of the subsystems and components of the electric propulsion system including (1) the thermionic fuel elements, (2) the heat rejection subsystem (heat pipes), (3) the power conditioning modules, and (4) the ion thrusters. Both flashlight and external fuel type in-core thermionic reactors are considered as the power source. The thermionic fuel elements would be useful over a range of reactor power levels. Electrical heated acceptance testing in their flight configuration is possible for the external fuel case. Nuclear heated testing by sampling methods could be used for acceptance testing of flashlight fuel elements. The use of heat pipes for cooling the collectors and as a means of heat transport to the radiator allows early prototype or flight configuration testing of a small module of the heat rejection subsystem as opposed to full scale liquid metal pumps and radiators in a large vacuum chamber. The power conditioner (p/c) is arranged in modules with passive cooling. Author

N72-25704*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMIONIC REACTOR ELECTRIC PROPULSION SYSTEM REQUIREMENTS
J. F. Mondt, C. D. Sawyer, and R. W. Schaupp 1 Jun. 1972 27 p refs
(Contract NAS7-100)
(NASA-CR-126867; JPL-TM-33-549) Avail: NTIS HC $3.50 CSCL 21C

Mission analysis, system analysis and mission engineering studies were conducted to find a single nuclear electric propulsion (NEP) system which would be applicable for a broad range of unmanned outer planet missions. The NEP system studied uses an in-core nuclear thermionic reactor as the electric power source and mercury bombardment ion engines for propulsion. Many requirements, which are imposed on the NEP system by the mission, were determined from the studies in the process of trying to find a single NEP system for many missions. The NEP system requirements are preliminary in nature and subject to small changes with further iterations between these types of studies and the technology program. It was determined that other applications for in-core thermionic reactors must also be considered in determining specific reactor requirements. It is concluded that a single thermionic reactor NEP system could be useful for a broad range of unmanned outer planet missions. It is proposed that thermionic reactor NEP system have: (1) a power level in the range of 70 to 120 kWe, (2) a system specific weight of approximately 30 kg/kWe, and (3) a full power output capability of 20,000 hours. Author

N72-25705*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER. VOLUME 1: EXECUTIVE SUMMARY
15 Mar. 1972 82 p refs
(Contract NAS8-28218)
(NASA-CR-123664; SE-019-008-2H-A-Vol-1) Avail: NTIS HC $6.25 CSCL 21H

An overview is presented of the results of the analyses conducted in support of the selected engine system for the pressure-fed booster stage. During initial phases of the project, a gimbaled, regeneratively cooled, fixed thrust engine having a coaxial pintle injector was selected as optimum for this configuration. D.L.G.

N72-25706*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER. VOLUME 2: TECHNICAL REPORT
15 Mar. 1972 463 p refs
(Contract NAS8-28218)
(NASA-CR-123667; SE-019-008-2H-B-Vol-2) Avail: NTIS HC $25.25 CSCL 21H

The results are summarized of the analyses conducted in support of the selected engine system for the pressure-fed booster stage. Various alternatives are also technically compared where appropriate. Author

N72-25707*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER. VOLUME 3, PART 1: PROGRAM ACQUISITION PLANNING
C. D. Olsen 15 Mar. 1972 129 p refs
(Contract NAS8-28218)
(NASA-CR-123666; SE-019-008-2H-C-Vol-3-Pt-1) Avail: NTIS HC $8.50 CSCL 21H

Planning documentation is presented covering the specific areas of project engineering and development, management, facilities, manufacturing, logistic support maintenance, and test and product assurance. Author

N72-25708*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER. VOLUME 3, PROGRAM ACQUISITION PLANNING PART 2: PROGRAM COSTS Final Cost Estimates, Phase A/B
A. C. Ellings 15 Mar. 1972 41 p refs
(Contract NAS8-28218)
(NASA-CR-123673; SE-019-008-2H-C-Vol-3-Pt-2) Avail: NTIS HC $4.25 CSCL 21H

Final cost estimates are presented for the selected engine configurations and schedules considered in the study Author

N72-25709*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY STUDY OF A PRESSURE-FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER. DESIGN DATA BOOK
W. M. King 15 Mar. 1972 37 p ref
(Contract NAS8-28218)
(NASA-CR-123674; SE-019-011-2H) Avail: NTIS HC $4.00 CSCL 21H

The preliminary operating specification, envelopes, and weight are presented for the selected engine system, subsystems and other CEI's Author

N72-25710*# Electro-Optical Systems, Inc., Pasadena, Calif.
COLLOID THRUSTER TECHNOLOGY Final Report, Aug. 1970 - Sep. 1971
Julius Perel Sep. 1971 136 p refs
(Contract NAS5-21025)
(NASA-CR-122385; Rept-4040-F) Avail: NTIS HC $9.00 CSCL 21C

A program is described for attaining control, reproducibility, and predictability of operation for the annular colloid emitter. A thruster of an improved design was used for a 1000 hour test. The thruster was operated with a neutralizer for 1023 hours at 15 kV with an average thrust of 25 micropound and specific impulse of 1160 sec. The performance was stable, and the beam was vectored periodically. The clean condition of the emitter edge at the end of the test coupled with no degradation in performance during the test indicated that the lifetime could be extrapolated by at least an order of magnitude over the test time. Author

N72-25711*# AiResearch Mfg. Co., Los Angeles, Calif.
HYPERSONIC RESEARCH ENGINE PROJECT. PHASE 2: STRUCTURES AND COOLING DEVELOPMENT Interim Technical Report, 3 May - 2 Aug. 1970
L. F. Jilly 1 Sep. 1970 98 p refs
(Contract NAS1-6666)
(NASA-CR-112055; AP-70-6640; ITR-14) Avail: NTIS HC $7.00 CSCL 21E

The flightweight components were adapted to form the basic engine assembly. The water cooled test adapters for use in wind tunnel tests were fabricated. Commercially available valves were selected for the coolant control system. The simplification of the temperature control concept and of the absence of weight and volume constraints made it possible to use these valves. Various calibration tests are also discussed. J.A.M.

N72-25712*# AiResearch Mfg. Co., Los Angeles, Calif.
HYPERSONIC RESEARCH ENGINE PROJECT. PHASE 2: STRUCTURES AND COOLING DEVELOPMENT Interim Technical Data Report, 3 Aug. - 2 Nov. 1970
L. F. Jilly, ed. 24 Nov. 1970 33 p
(Contract NAS1-6666)
(NASA-CR-112056; AP-70-6939; ITDR-15) Avail: NTIS HC $3.75 CSCL 21E

The structures assembly model (SAM) was installed, and wind tunnel systems were checked out. The first run, with hydrogen cooling and SAM inserted in the wind tunnel stream (M = 7.7, P sub TOTAL = 900 psia, T sub TOTAL = 2500 deg R), was accomplished. The condition of the SAM after the run was satisfactory, with no visible signs or data indications of overheating or overloading. Author

N72-25713*# AiResearch Mfg. Co., Los Angeles, Calif.
HYPERSONIC RESEARCH ENGINE PROJECT. PHASE 2: AEROTHERMODYNAMIC INTEGRATION MODEL DEVELOPMENT Interim Technical Data Report, 10 Jun. - 9 Sep. 1970
L. F. Jilly, ed. 15 Oct. 1970 100 p refs
(Contract NAS1-6666)
(NASA-CR-112058; AP-70-6800; ITDR-10) Avail: NTIS HC $7.00 CSCL 21E

The analytical effort was directed towards (1) completing the design of the combustor exit instrumentation assembly, (2) analyzing the coolant flow distribution of the cowl leading edge tip section, (3) determining effects of purge gas pressure on AIM performance analysis, and (4) analyzing heat transfer and associated stress problems related to the cowl leading edge tip section and the nozzle shroud assembly for test conditions. Author

N72-25714*# AiResearch Mfg. Co., Los Angeles, Calif.
HYPERSONIC RESEARCH ENGINE PROJECT. PHASE 2: AEROTHERMODYNAMIC INTEGRATION MODEL DEVELOPMENT Interim Technical Data Report, 10 Sep. - 9 Dec. 1970
L. F. Jilly, ed 6 Jan. 1971 74 p
(Contract NAS1-6666)
(NASA-CR-112059; AP-70-7035; ITDR-11) Avail: NTIS HC $5.75 CSCL 21E

The analytical effort was directed toward (1) analyzing the latest inputs of possible test conditions and their impact on hardware; (2) review structural capabilities of the AIM unit; (3) analyzing coolant flow paths, heat transfer, and associated problems relative to the cowl leading edge tip section; and (4) redefining requirements of flow-calibrating the air-metering duct. Author

N72-25715*# AiResearch Mfg. Co., Los Angeles, Calif.
HYPERSONIC RESEARCH ENGINE PROJECT. PHASE 2: AEROTHERMODYNAMIC INTEGRATION MODEL DEVELOPMENT Interim Technical Data Report, 10 Dec. 1970 - 9 Mar. 1971
L. F. Jilly, ed. 30 Mar. 1971 31 p refs
(Contract NAS1-6666)
(NASA-CR-112060; AP-71-7279; ITDR-12) Avail: NTIS HC $3.75 CSCL 21E

The fabrication of the various components of the HRE AIM was completed. The purge system necessary for the cavity bounded by the outer shell assembly and the outer cowl body was studied. Preparations were begun for establishing a format for test data acquisition and reduction. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-25716 North Texas State Univ., Denton.
A STUDY OF SOLAR COSMIC RAY FLARE EFFECTS Ph.D. Thesis
Edwin Paul Keath 1971 158 p
Avail: Univ. Microfilms Order No. 71-25367

The design and construction of a cosmic ray detector system and the analysis of the data are described. The systems were flown aboard the Pioneers 8 and 9. The analysis indicates that during each event there exists three distinct phases characteristic of the particle flow. At very early time (< 1 day) the cosmic ray anisotropy is large and aligned with the interplanetary magnetic field lines. During the interval of 2 to 4 days the anisotropy is observed to be directed radially with an amplitude of 5 to 15%. At late times (< 4 days) the anisotropy is observed to be consistently aligned perpendicular to the nominal interplanetary field lines. Measurements of the longitudinal gradients indicate the presence of strong gradients in heliocentric longitude even at very late times. From the energy spectrum of the cosmic ray particles it is shown that the spectral exponent is dependent on the location of the observer relative to the centorid of the cosmic ray population. Dissert. Abstr.

N72-25717 Catholic Univ. of America, Washington, D.C.
A SEARCH FOR ANISOTROPIES IN COSMIC RAY SOURCES BETWEEN 9 DEG AND 69 DEG DECLINATION Ph.D. Thesis
Emmanuel M. Carreira 1971 136 p
Avail: Univ. Microfilms Order No. 71-25023

A survey of the distribution of cosmic ray sources was carried out by means of a spark chamber, which allowed the determination of the incoming direction of secondary cosmic ray particles (muons). From the analysis of 39,111 events, a map of the sky was drawn in terms of the relative number of tracks originating within each given area. The resulting pattern seems

to indicate a direct relationship between cosmic ray flux and the structure of the galaxy in the vicinity of the solar system. The particles detected correspond to primaries with energies of the order of 30 GeV. A model of the galactic field with the main component directed along the spiral arms and a weaker dipole field perpendicular to the disk, would lead to an expected anisotropy in the cosmic ray flux, with higher intensity in the direction of the local arm and, perhaps, in the direction of the galactic pole. The observed pattern agrees with this model.
Dissert. Abstr.

N72-25718# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC EFFECTS OF SOLAR FLARES. 6: FLARE TIME MODELS OF IONIZATION PROFILES IN THE D REGION
A. P. Mitra and S. D. Deshpande Aug. 1971 18 p refs Presented at the 14th Plenary Meeting of COSPAR, Seattle, 18 Jun. - 2 Jul. 1971
(E-2-68(N))
(RSD-68; SR-68; PL-480-12) Avail: NTIS HC $3.00

Several electron density profiles were obtained with a high power wave interaction facility, a partial reflection experiment, a series of rocket firings, and multifrequency VLF and riometer experiments. For some of these the time histories as well as the spectral distributions of the ionizing X-ray fluxes are known. These provide information on nitric oxide concentration at D region heights, the changes in the effective recombination coefficient during SIDS, and the relative importance of the competing ionizing sources. It seems possible to develop models of flare time D region electron densities for a wide range of flare conditions in terms of the X-ray flux at 0 to 8 A and a parameter such as the flux ratio at 0 to 3 A and 0 to 8 A defining the flare spectrum.
Author

N72-25719# National Physical Lab., New Delhi (India). Radio Science Div.
SOLAR ACTIVITY VARIATION OF NO(PLUS)/O2(PLUS) AND NO(PLUS)/O(PLUS) IN E AND F REGIONS
A. P. Mitra and Purobi Benerjee Aug. 1971 19 p refs
(RSD-67) Avail: NTIS HC $3.00

Studies of ionospheric ion composition measured at different phases of solar activity reveal that during day and for heights less than 160 km, the ratio NO(+)/O2(+) increases from low to high activity by a factor of 6 to 2 in the height range 120 km to 150 km, and for heights above 160 km NO(+)/O(+) increases by a factor of 1.3 to 2.4 for the height range 170 km to 200 km as the 10.7 cm flux increases from 70 to 250 units. The increase in NO(+)/O2(+) can be related to an increase in the minor constituents (NO + 4N) which increase by a factor of 7 at 130 km. The increase in NO(+)/O(+) is interpreted on the basis of changes in neutral composition and on an increase in the value of rate coefficient for the reaction O(+) + N2 yields NO(+) + O, indicating an increase in vibrational temperature. The estimated vibrational temperatures of 200 km are 1600 deg and 1675 K during low and high solar activity.
Author

N72-25720# Catholic Univ. of America, Washington, D.C. Dept. of Aerospace and Atmospheric Sciences.
A SOLAR-WIND MODEL INCLUDING PROTON THERMAL ANISOTROPY
Y. C. Whang Apr. 1972 40 p refs
Avail: NTIS HC $4.00

The model divides the interplanetary space into two regions, assuming that the solar wind is one-fluid in an inner region <0.4 AU and two-fluid and collisionless in an outer region >0.4 AU. The second and third moment equations of the Vlasov equation together with other conservation equations are used to govern the solar wind flow in the outer region. The model produces solutions for all macroscopic quantities as well as for the microscopic proton distribution function as functions of heliocentric distances up to 50 AU and beyond. The calculated results at 1 AU give the following values: the solar wind velocity = 331 km/sec; the electron temperature = 152,000 K; the proton temperature = 75,000 K; the proton thermal anisotropy = 2.23; the number density n = 5.5 protons/cu cm; the electron heat flux = 0.0049 ergs/sec/sq cm; the proton heat flux = 0.00011 ergs/sec/sq cm; the magnitude of the magnetic field = 6.3 gammas; the direction angle of the field = 130 deg; and the plasma beta value = 1.09. They are in good agreement with observations. The predicted distribution function at 1 AU also resembles the distribution function reconstructed from observational data.
Author

N72-25721# National Oceanic and Atmospheric Administration, Washington, D.C.
THE OPERATIONAL PROCESSING OF SOLAR PROTON MONITOR AND FLAT PLATE RADIOMETER DATA
Henry L. Phillips and Louis Rubin May 1972 24 p refs
(NOAA-TM-NESS-29) Avail: NTIS HC $3.25

The operational processing of data is described which was obtained from flat plate radiometer and solar proton monitor sensors flown on environmental satellites of the TIROS (television infrared observation satellite) series named ITOS (improved TIROS operational satellite). Hardware systems aboard the ITOS are discussed, and the software procedures relevant to data recovery, recording, and transmission problems are described. Descriptions are included of tape formats, message formats, data location procedures, data frame contents, and a partial index of processed data available in archival form.
Author

N72-25722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR MODULATION OF GALACTIC COSMIC RAYS. 3: IMPLICATIONS OF THE COMPTON-GETTING CO-EFFICIENT
L. A. Fisk, M. A. Forman (State Univ. of New York, Stony Brook), and W. I. Axford (Calif. Univ., LaJolla) Apr. 1972 33 p refs
(NASA-TM-X-65901; X-661-72-124) Avail: NTIS HC $3.75 CSCL 03B

Spectra of modulated galactic cosmic rays are expressed in terms of the Compton-Getting coefficient C. This parameter can reveal the energy range over which the force field approximation is valid, and the range where convection effects dominate those of diffusion. A value of C near zero over an extended low energy range implies that the radial gradient at low energies cannot be large. This small gradient may imply that the diffusion coefficient increases beyond 1 AU less rapidly than proportionally to heliocentric radial distance, and/or there is essentially no scattering for a sizeable distance from the Sun to earth. The behavior of C with rigidity (or energy) is discussed in terms of the omnidirectional distribution function f sub zero. Contours of constant f sub zero in the heliocentric distance vs rigidity plane are useful for illustrating the mean rigidity loss experienced by cosmic rays in the interplanetary medium.
Author

N72-25723*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF 2-20 keV X-RAYS FROM THE CYGNUS REGION
Richard D. Bleach Jun. 1972 130 p refs
(Grant NGL-21-002-033)
(NASA-TM-X-65903; X-661-72-152) Avail: NTIS HC $8.50 CSCL 03B

Two rocket-borne proportional counters, each with 650 sq c, met area and 1.8 x 7.1 deg FWHM rectangular mechanical collimation, surveyed the Cygnus region in the 2 to 20 keV energy range on two occasions. X-ray spectral data gathered on 21 September 1970 from discrete sources in Cygnus are presented. The data from Cyg X-1, Cyg X-2, and Cyg X-3 have sufficient statistical significance to indicate mutually exclusive spectral forms for the three. Upper limits are presented for X-ray intensities above 2 keV for Cyg X-4 and Cyg X-5 (Cygnus loop). A search was made on 9 August 1971 for a diffuse component of X-rays $>$ 1.5 keV associated with an interarm region of the

galaxy at galactic longitudes in the vicinity of 60 degrees. A statistically significant excess associated with a narrow disk component was detected. Several possible emission models are discussed, with the most likely candidate being a population of unresolvable low luminosity discrete sources. Author

N72-25724*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE CORONAL TRANSPORT OF THE FLARE ASSOCIATED SCATTER FREE ELECTRONS
J. R. Wang Mar. 1972 22 p refs Submitted for publication
(NASA-TM-X-65887; X-661-72-76) Avail: NTIS HC $3.25 CSCL 03B

A total of 11 scatter-free electron events from McMath plage region 8905 were observed by IMP 4 during the period from 29 July to 3 August 1967. The transit times and duration of these electron events are examined in detail. The duration of 170- to 1000-keV electrons shows a strong dependence upon the heliolongitude of the associated flare. Typical values of the duration full width at half maximum vary from 4 min at 50 deg W to 12 min at 10 deg and 90 deg W heliolongitudes. In addition, the difference in times at which the maximum intensities of the 22- to 45-keV and 170- to 1000-keV electrons occur is observed to change from 18 min near 50 deg W to 13 min at 10 deg and 90 deg W heliolongitudes. An idealized two-dimensional diffusion model for the transport of these electrons in the solar corona is proposed. The 22- to 45-keV electrons escape promptly from flare site to the feet of the interplanetary magnetic field lines, whereas 170- to 1000-keV electrons suffer slight scattering. The diffusion coefficient for 170- to 1000-keV electrons is estimated to be 3 X 10 to the 18th power sq cm/sec. Finally, a possible relation between the scatter-free and the classical diffusive-type electron events is discussed. Author

N72-25725# Bern Univ. (Switzerland).
COSMIC AND SOLAR SYSTEM ABUNDANCES OF DEUTERIUM AND HELIUM-3
J. Geiss and H. Reeves (Inst. d'Astrophys., Paris) [1972] 23 p refs Submitted for publication
Avail: NTIS HC $3.25

From an analysis of solar and solar wind abundances it is concluded that the D/H ratio in the protosolar gas was much smaller than it is found in ocean water or carbonaceous chondrites. Best estimates for the protosolar gas are: D/H = 0.00003 and He-3/H = 0.00001. Isotopic enrichment of deuterium is thought to have occurred in the solar nebula prior to or during accretion of planetary bodies, mainly as a result of chemical reactions of hydrogen with oxygen and other elements. Chemical equilibrium reactions at low temperature actually lead to large D enrichment, in agreement with the conclusion derived from solar data. The D and He-3 abundances in the protosolar gas are consistent with a Big Bang origin of these nuclei, corresponding to a universal baryonic density of 3 x 10 to the minus 31st power g/cu cm (deceleration parameter approximately 0.01) and zero leptonic number. Author

N72-25726*# California Inst. of Tech., Pasadena.
MAGNETOSPHERIC ACCESS OF SOLAR PARTICLES AND THE CONFIGURATION OF THE DISTANT GEOMAGNETIC FIELD, VOLUME 1 Ph.D. Thesis
Lawrence Curtis Evans 1972 164 p
(Contract NAS5-3095; Grant NGL-05-002-007)
(NASA-CR-122359) Avail: NTIS HC $10.25 CSCL 03B

The access of 1.2 to 40 MeV protons and 0.4 to 1.0 MeV electrons from interplanetary space to the polar cap regions was investigated with an experiment on board a low altitude, polar-orbiting satellite (OGO 4). A total of 333 quiet time observations of the electron polar cap boundary give a mapping of the boundary between open and closed geomagnetic field lines. Observations of events associated with co-rotating regions of enhanced proton flux in interplanetary space were used to establish the characteristics of the 1.2 to 40 MeV proton access windows. The results were compared to particle access predictions of the distant geomagnetic tail configurations. The role played by interplanetary anisotropies in the observation of persistent polar cap features is discussed. Special emphasis is given to the problem of nonadiabatic particle entry through regions where the magnetic field is changing direction. Author

N72-25727*# California Inst. of Tech., Pasadena.
MAGNETOSPHERIC ACCESS OF SOLAR PARTICLES AND THE CONFIGURATION OF THE DISTANT GEOMAGNETIC FIELD, VOLUME 2 Ph.D. Thesis
Lawrence Curtis Evans 1972 120 p refs
(Contract NAS5-3095)
(NASA-CR-122360) Avail: NTIS HC $8.00 CSCL 03B

A summary is provided of all proton events observed with OGO/4 and observed flux profiles for several events. Pertent data are indicated relating to the orientation of the interplanetary magnetic field. The events whose profiles are presented are divided into three classes: EDP events (normally associated with co-rotating features), solar flare events, and events having characteristics of both EDP events and flare events (class C events). A description of these classes of events and the criteria used to distinguish between EDP events and flare events are discussed. In addition, the 1 December 1967 EDP event and the 2 November 1967 solar flare event are discussed in some detail. Accompanying the profiles of each event is a brief list of notable observational features of the event. Events are presented chronologically. Author

N72-25728# Uppsala Univ. (Sweden). Cosmic Ray Group.
MODULATION EFFECTS IN THE COSMIC RAY INTENSITY AND THEIR DEPENDENCE ON SUNSPOT NUMBER 10.7 cm RADIO FLUX AND GEOMAGNETIC ACTIVITY
Sivgard Ruthberg and Sayed Abdel Wahab 15 Jun. 1971 23 p refs
(Contract F61052-68-C-0034; AF Proj. 8600)
(AD-737848; AFCRL-71-0540; UU/CRG-71-3; SN-1) Avail: NTIS CSCL 03/2

The 27-day recurrency in the galactic cosmic ray intensity and its dependence on sunspot number, 10.7 cm radio flux and geomagnetic activity has been studied through the years 1958-1969. In 1966-67 a strong periodic correlation is found between the solar activity and the cosmic ray intensity. The geomagnetic activity and the cosmic ray intensity are found to be strongly related both at solar maximum and solar minimum of activity. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-25729 New Hampshire Univ., Durham.
MHD WAVES NEAR THE MAGNETOPAUSE Ph.D. Thesis
Allan Wolfe 1971 107 p
Avail: Univ. Microfilms Order No. 71-25419

Explorer 12 magnetometer data was used to study MHD waves near the magnetopause. Wave power from both sides of the magnetopause near the earth-sun line were compared by forming ratios of the power spectral density inside to outside the boundary in separate frequency bands. Two data groups were separated for the onset of Kelvin-Helmholtz instability at the magnetopause. In one data group, representative of a stable magnetopause, the power spectral density ratios were less than 0.11 for waves with periods from two minutes to thirty seconds. The other data group, representative of an unstable magnetopause, had power spectral density ratios near 1.0 for the above period range. The magnetopause was represented as a plane boundary having no normal magnetic field component.

Power spectral density ratios were calculated for magnetoacoustic waves incident upon a tangential discontinuity. Dissert. Abstr.

N72-25730 Catholic Univ. of America, Washington, D.C.
A STUDY OF THE MOTION OF A CABLE SYSTEM TOWED FROM AN ORBITING VEHICLE Ph.D. Thesis
Barry John Noonan 1971 167 p
Avail: Univ. Microfilms Order No. 71-25568

The configuration of a class of laboratory-simulated towed cable systems was determined. The results were used to evaluate analytical models for the system in order to assess their validity and to identify the dominant features governing system performance. The towpoint of the vehicle was restricted to steady state circular motion. The experiments were conducted on nylon and stranded steel test specimens which varied in diameter and length. The effects of the various physical and operational parameters on the system were demonstrated. Two mathematical models which predict towline performance were investigated. A simplified analysis based on the approach of lumped masses was derived and compared with a more rigorous model treating the towline as a continuum. Both models were found to adequately predict the heavy towline performance for low towing speeds and/or when the towed body is heavy. At greater speeds the continuous model was found to give better results. Dissert. Abstr.

N72-25731 British Broadcasting Corp., Kingswood (England). Engineering Div.
VARIATION OF LOW-FREQUENCY SKY-WAVE FIELD STRENGTH WITH SOLAR ACTIVITY IN EUROPE
P. Knight and J. P. Crean May 1972 6 p ref
(BBC-1972/12) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Low-frequency sky-wave field strengths measured late at night during the solar cycle were analyzed, but no clear dependence on solar activity was found. It is therefore recommended that the influence of solar activity on low-frequency sky-wave field strength should be disregarded for the time being. Author

N72-25732 Colorado Univ., Boulder.
STUDIES OF HYDRODYNAMICAL AND RADIATIVE TRANSFER EFFECTS IN A RR LYRAE ATMOSPHERE Ph.D. Thesis
Stephen James Hill 1971 173 p
Avail: Univ. Microfilms Order No. 71-25835

Models of RR Lyrae stars were produced which have duplicated pulsational instability. To understand the action of the pulsating atmosphere, a series of modeling techniques were employed in a computer numerical solution. Tables were constructed from atomic data which describe the absorptive and scattering opacities, internal energies and electron pressures at the conditions of temperature and density encountered in the atmosphere. The tables were used in a hydrodynamic radiative transfer LTE model atmosphere which was driven at the photosphere by a piston simulating the action of the pulsation of the star. Dissert. Abstr.

N72-25733 Cornell Univ., New York.
CARBON-RICH STARS WITH HELIUM ENVELOPES Ph.D. Thesis
Paul Christopher Joss 1971 149 p
Avail: Univ. Microfilms Order No. 71-25161

The evolution of stellar models was investigated for masses between 0.75 and 1.37 solar mass. The models had cores comprised of 50% C-12 and 50% O-16 by mass, and envelopes of pure helium. A sequence of 1.37 solar mass models with initial helium envelopes of 5.5%, 21%, 32%, and 50% was calculated. The evolution of a 0.75 solar mass model with 5.5% initial helium envelope, and a sequence of 1.02 solar mass models with 0%, 2.3%, and 5.5% initial helium envelopes, were also calculated. All of these models evolved directly into white dwarfs without igniting carbon, although most of the helium envelopes were consumed. Dissert. Abstr.

N72-25734 Wisconsin Univ., Madison.
INTERSTELLAR ABSORPTION OF THE CRAB NEBULA'S SOFT X-RAY FLUX AND THE X-RAY SPECTRUM OF THE CRAB PULSAR Ph.D. Thesis
Philip Lynn Coleman 1971 152 p
Avail: Univ. Microfilms Order No. 71-20660

Results are presented for a sounding rocket observation of the Crab nebula with X-ray detectors sensitive over the energy interval 0.1 to 12 keV. On the assumption that the Crab's X-ray emission below 1 1/2 keV is a smooth extrapolation of its 1 1/2 to 10 keV spectrum, data show an attenuation of the flux below 1.5 keV due to absorption by the interstellar gas. Data were analyzed in terms of the emission due to the pulsar imbedded in the Crab nebula. The intensity of the pulses relative to the continuous nebular radiation increases by a factor of two between 1 and 10 keV. Dissert. Abstr.

N72-25735 California Inst. of Tech., Pasadena.
THE LITHIUM ISOTOPE RATIO IN F AND G FIELD STARS Ph.D. Thesis
Judith Gamora Cohen 1971 220 p
Avail: Univ. Microfilms Order No. 71-27095

Theoretical profiles of the resonance line of Li I were computed using an absorption coefficient and a model stellar atmosphere. These profiles were used to verify lithium abundances. Profiles of 6708 A of Li I, 6717 A of Ca I, 6710.3 A of Fe I, and the D lines of Na I for a selected group of F, G, and early K field stars were observed with the Fabry-Perot interferometer at the Coude focus of the 100-inch telescope with a resolution of 0.06 to 0.09 A. The observed stellar line profiles are fit by calculated ones to determine the lithium abundance, calcium abundance, rotational velocity, radial velocity, microturbulent velocity, and lithium isotope ratio for the stars. The rotational velocities are all greater than 2 km/sec, and range up to 10 km/sec. The microturbulent velocities in the program stars must be greater than zero. The isotope ratio Li-6/Li-7, determined by two independent methods, is zero in all the stars, with the possible exception of chi Ori. Dissert. Abstr.

N72-25736 Arizona Univ., Tucson.
THE DISTRIBUTION OF O AND EARLY B STARS, GAS AND COSMIC DUST ACROSS THE CARINA SPIRAL FEATURE Ph.D. Thesis
Ellis Wilson Miller 1971 255 p
Avail: Univ. Microfilms Order No. 71-24893

Photometric and photographic data collected at the Cerro Tololo Interamerican Observatory were used to search for faint blue stars in the Carina spiral feature and to study the longitudinal distribution of interstellar absorption. The distribution of H I across the Carina spiral arm is very broad. At a distance of 4 kpc from the sun, the width of the densest H I concentrations is 1000 parsecs. Less dense H I spills out at each edge, and increases the width by at least 500 parsecs. The ionized H II regions have a narrower longitude distribution, between 282 and 292 deg. At a distance of 4 kpc from the sun the width of the H II distribution is approximately 800 parsecs. The search resulted in the identification of 133 new OB stars. Most of these stars are fainter than 13th magnitude. The largest numbers of faint blue stars are found near 289 deg. The colors and magnitudes of the faint blue stars are used to study the distribution of interstellar absorption across the Carina spiral feature. Total absorption values as large as 3 to 4 magnitudes are found. Dissert. Abstr.

N72-25737 Rice Univ., Houston, Tex.
FAR-INFRARED OBSERVATIONS OF GALACTIC H II REGIONS Ph.D. Thesis
Doyal Alexander Harper, Jr. 1971 124 p
Avail: Univ. Microfilms Order No. 71-26293

The DR-21, K3-50, M 17, M 42, NGC 2024, W 49, W 51, and NGC 7027 were observed between 40 and 750 microns. Large fluxes were detected from all of the objects except NGC 7027. The luminosities range from 20,000 to 20 million solar luminosities. Measurements of M 17, M 42, NGC 2024, and W 51 indicate that the sources are extended, optically thin, and have temperatures between 50 and 130 K. The far infrared sources appear to be coincident with bright, compact, thermal radio sources, and the flux is proportional to the high-frequency radio density. The total mass of dust particles required to absorb a large fraction of the total luminosity of the hot, massive stars producing an H II region and re-emit the energy as far-infrared radiation is consistent with cosmic abundances and the mass of nebular H II gas calculated from the radio data. The absence of such a primordial dust and gas cloud could explain the failure to detect far-infrared emission from NGC 7027. Dissert. Abstr.

N72-25738 Washington Univ., St. Louis, Mo.
ZONAL HARMONIC PERTURBATIONS OF SATELLITE ORBITS Ph.D. Thesis
Daniel L. Rosamond 1971 90 p
Avail: Univ. Microfilms Order No. 71-27368

Perturbations due to harmonics through the seventh are derived in detail, and the technique is organized so that effects of higher harmonics may be readily added. Solutions are developed by a series expansion method using orbit parameters that are free of singularities at zero eccentricity and zero inclination. The theory is a variation-of-parameters-type with an angular position independent variable which is the sum of longitude of the ascending node and the in-plane argument of latitude. An accurate position-time relation based on the energy integral is included. Comparisons of orbit computations based on the explicit solution equations with results of precise numerical integrations are presented. Dissert. Abstr.

N72-25739 California Inst. of Tech., Pasadena.
INFRARED SPECTRA OF LATE-TYPE STARS Ph.D. Thesis
Jay Albert Frogel 1971 272 p
Avail: Univ. Microfilms Order No. 71-26127

Spectra were obtained in the 2 micron atmospheric window with a resolution of 32 and 65A of late-type dwarfs, giants, supergiants, and long period variables. In the nonvariable stars, the first overtone band of CO at 2.29 microns shows a systematic increase with both increasing luminosity and decreasing temperature. Variations in the strengths of the H2O and CO bands were measured in 18 long period variables, as well as variations in the continuum flux at 2.25 microns, f(225). There is evidence for differences in the value of (O/C) among the variable stars. A model involving the motion of a shock wave through the star's atmosphere is discussed as a possible means of explaining variations in both visual and infrared spectra. The evolutionary history of, and the effect of convective mixing in, late-type stars are discussed. Dissert. Abstr.

N72-25740 Colorado Univ., Boulder.
RADIO SCINTILLATION OBSERVATIONS IN THE IONOSPHERE AND INTERPLANETARY MEDIUM Ph.D. Thesis
Clifford Leroy Rufenach 1971 167 p
Avail: Univ. Microfilms Order No. 71-25870

Scintillation observations were carried out at meter wavelengths at Table Mountain near Boulder, Colorado, during the winter of 1969 and summer of 1970. Nighttime scintillations of the small diameter component of the radio source Taurus A are attributed to irregularities in the ionosphere and in the interplanetary medium; however, the nighttime scintillations from larger diameter radio sources, Virgo A, Cygnus A, and Cassiopeia A, are attributed to irregularities in the ionosphere only. Power spectra of the intensity fluctuations were analyzed for all of the observations. The observing time was always chosen to be longer than one hour; in this way narrow confidence limits for the power spectral estimates were obtained. In addition to the single-site single-frequency observations, both spaced-site and two-frequency observations were taken on the radio source Cassiopeia A. Dissert. Abstr.

N72-25741 Rice Univ., Houston, Tex.
SEARCH FOR HYPERFINE LINE FROM SINGLY IONIZED HELIUM-3 IN GALACTIC H-2 REGIONS Ph.D. Thesis
Clayton Read Predmore 1971 147 p
Avail: Univ. Microfilms Order No. 71-26342

An attempt is described to measure the cosmic abundance of the He-3 isotope through detection of hyperfine radiation at 8666 MHz from singly ionized He-3 in galactic diffuse nebulae. The 140-foot telescope at the National Radio Astronomy Observatory was used in the search, in conjunction with a cryogenic parametric amplifier receiver. From effective observational procedures and a thorough data analysis, an upper limit of 0.00004 for the (He-3)/H abundance ratio was established. The implication of this abundance was quantitatively analyzed in the light of existing cosmological theories and models of stellar and galactic evolution. A very faint hydrogen recombination was detected with a signal to noise ratio of 20; this line results from the high quantum level transitions between states of principle quantum number 178 and 171. Dissert. Abstr.

N72-25742*# Wisconsin Univ., Madison. Dept. of Physics.
A PLAUSIBLE ENERGY SOURCE AND STRUCTURE FOR QUASI-STELLAR OBJECTS
E. Daltabuit and D. Cox [1972] 12 p refs
(Grant NGL-50-002-044)
(NASA-CR-126723) Avail: NTIS HC $3.00 CSCL 03B

If a collision of two large, massive, fast gas clouds occurs, their kinetic energy is converted to radiation in a pair of shock fronts at their interface. The resulting structure is described, and the relevance of this as a radiation source for quasi-stellar objects is considered. Author

N72-25743*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
SOFT X-RAY ASTRONOMY PROPORTIONAL COUNTER ELECTRONICS
W. R. Gardner Dec. 1971 176 p refs
(Contract NAS9-12200; Grant NGR-05-003-278)
(NASA-CR-115509) Avail: NTIS HC $11.00 CSCL 04A

The X-ray multiwire proportional counter is designed to measure cosmic X-ray fluxes at sounding rocket altitudes in the energy range of 0.1 to 10 keV. Four instruments will be launched in a Black Brant 4 rocket employing different combinations of detector windows and gas. The detector is constructed with two layers of twelve cells. A columnator is mounted on the face of one layer whose cells are wired together alternately to form two main detector sections. The electronics and gas regulation systems are mounted on the face of the second layer whose cells are wired together to form one anticoincidence detector section. Normally X-rays will have short ionization paths in only one of the main detector cells at a time and won't enter the anticoincidence detector cells. To distinguish between X-rays and charged particles, the instrument includes a coincidence discriminator, an anticoincidence discriminator, and a pulse rise time discriminator. Author

N72-25744*# Battelle Memorial Inst., Richland, Wash.
EXPLORATORY DEVELOPMENT AND SERVICES FOR PREPARING AND EXAMINING ULTRATHIN POLISHED SECTIONS OF LUNAR ROCKS AND PARTICULATES, PART 2 Final Report
R. H. Beauchamp, J. F. Williford, and E. L. Gafford 23 Mar. 1972 26 p
(Contract NAS9-11993)
(NASA-CR-115554; Rept-211B00862) Avail: NTIS HC $3.50 CSCL 08G

General principles and details of the actual procedure are presented for the preparator. Some background information is given on why certain lapping, polishing, and gluing procedures

are needed. It is directed toward the innovative preparator who wishes to further refine procedures or to use some of his own techniques for some steps in the processing sequence. Specific details on the single procedure found to be most successful for lunar dense rocks, breccias, and particulates are outlined. A complete listing of equipment and supplies is appended. Author

N72-25745# Royal Greenwich Observatory, Herstmonceux (England).
THE EQUIVALENT WIDTHS OF SPECTRAL LINES IN TWELVE LATE F DWARFS
A. L. T. Powell 12 Jul. 1971 13 p refs
(Bull-167) Avail: NTIS HC $3.00; Roy. Greenwich Obs., Herstmonceux Castle, Hailsham, Sussex, Engl.: £0.25

The equivalent widths and other data for the spectral lines of twelve late F dwarfs are given. All the blue wavelength spectrograms were obtained on a 30-inch Coude. For one star (chi Her) plates in the red spectral region were obtained on the 100-inch Mount Wilson Coude. These data were used as the basis of differential curve-of-growth analyses. Author

N72-25746# Royal Greenwich Observatory, Herstmonceux (England).
SPECTRAL LINES FOR CURVE-OF-GROWTH ANALYSIS OF LATE-TYPE STARS, 1
A. L. T. Powell 16 Jul. 1971 34 p refs
(Bull-168) Avail: NTIS HC $3.75; Roy. Greenwich Obs., Herstmonceux Castle, Hailsham, Sussex, Engl.: £0.50

Spectral line constants, values of solar equivalent widths, and their desaturated values for the bifurcated and unbifurcated case are given. Author

N72-25747# Royal Greenwich Observatory, Herstmonceux (England).
MASSES, RADII AND LUMINOSITIES OF RR LYRAE VARIABLE STARS
Richard Woolley and Ann Savage 18 Oct. 1971 32 p refs
(Bull-170) Avail: NTIS HC $3.75; Roy. Greenwich Obs., Herstmonceux Castle, Hailsham, Sussex, Engl.: £0.50

The Baade-Wesselink method of determining radii of variable stars is examined. The idea is introduced that specific intensity in B and V is affected by gravity as well as by temperature. The stars were classified according to period and period-luminosity criteria. The galactic orbits were calculated, assuming an inverse square attracting field. About half the orbits of stars in Groups IIa and IIb are retrograde, and the median eccentricity in these Groups and also Group Ia is very high. On the other hand stars in Group Is describe orbits similar to those of late-type nearby stars. Author

N72-25748# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
SOME OH AND FORMALDEHYDE PROPERTIES OF W3 AND W51 REGIONS
J. Elider May 1970 28 p refs
(RR-96) Avail: NTIS HC $3.25

The continuum radiation and the spectral line radiation in the directions of W3 and W51 were compared. The investigation gives only very crude brightness distributions. Author

N72-25749# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
STAR FORMATION: A LITERATURE SURVEY
Per Ingvarson 1970 87 p refs
(Rept-101) Avail: NTIS HC $6.50

The formation of stars from galactic clouds is considered. Dynamic collapse, fragmentation, and the Helmholtz-Kelvin contraction are discussed. Galactic cloud rotation and the influence of a magnetic field on stellar evolution are reviewed. The formation of star clusters and double stars is also considered. K.P.D.

N72-25750# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
OBSERVATIONS OF THE HYDROGEN RECOMBINATION LINE 116 ALPHA AT 4159 MHz
Bertil Hoeglund Sep. 1970 10 p refs
(Rept-98) Avail: NTIS HC $3.00

The galactic H II regions Orion A, M 17, IC 434, IC 1795 and W 51 were observed with a 25.6-m telescope and a 24-channel filter receiver (bandwidth 100 kHz). Electron temperatures were derived on the assumption of local thermodynamic equilibrium. Author

N72-25751# Tapia de Navarro (Graciela), La Paz (Bolivia).
SCIENTIFIC THEORY ON THE ORIGIN OF THE SOLAR SYSTEM [TEORIA CIENTIFICA SOBRE EL ORIGEN DEL SISTEMA SOLAR]
Graciela Tapia de Navarro 1970 19 p In SPANISH
Avail: NTIS HC $3.00

A theory, based on solar activity, for the origin of the solar system is discussed. The formation of the planets and their atmospheres, the origin of the sun, and meteorites are also discussed. The observations since 1949 supporting the theory are presented. Transl. by F.O.S.

N72-25752*# Translation Consultants, Ltd., Arlington, Va.
THE FUSION CRUST OF THE KUNASHAK STONY METEORITE
I. A. Yudin NASA Washington May 1972 7 p refs Transl. into ENGLISH from Meteoritika (Moscow), no. 13, 1955 p 143-146
(Contract NASw-2038)
(NASA-TT-F-14269) Avail: NTIS HC $3.00 CSCL 03B

The mineralogical composition of islets in the fusion crust of the Kunashak meteorite and sections of its crustless surface is discussed. The minerals studied were mostly opaque minerals in reflected light at high magnification, but those in transmitted light in immersion specimens were also included. Author

N72-25753*# National Aeronautics and Space Administration, Washington, D.C.
PHYSICAL STUDIES OF MINOR PLANETS
Tom Gehrels, ed. (Ariz. Univ., Tucson) 1971 713 p refs Conf. held at Tucson, Ariz., 6-10 Mar. 1971
(NASA-SP-267) Avail: NTIS; SOD $3.00 CSCL 03A

Astronomical observations of the asteroids are discussed. The origin of asteroids and their interrelationships with comets, meteorites, and meteors are considered. Possible space missions and further topics of research are also discussed. K.P.D.

N72-25754*# California Univ., Los Angeles. Dept. of Chemistry and Institute of Geophysics and Planetary Physics.
TRACE ELEMENT STUDIES OF ROCKS AND SOILS FROM OCEANUS PROCELLARUM AND MARE TRANQUILLITATIS
Philip A. Baedecker, Rudolf Schaudy, John L. Elzie, Jerome Kimberlin, and John T. Wasson [1972] 62 p refs
(Contracts NAS9-8095; NAS9-8096; NAS9-8843)
(NASA-CR-115570) Avail: NTIS HC $5.25 CSCL 03B

Neutron activation data on Zn, Ga, Ge, Cd, In and Ir are reported for six rocks and two soils from the Apollo 12 mission. Comparison of these and similar data for Apollo 11 samples indicates extralunar components in the 12070 and 10084 soils of about 1.0 and 1.1% expressed in terms of an assumed composition which is the same as the water-free portion of C1 chondrites. A relationship between the integrated flux of extralunar material and the increase in concentration of such material in the fines of the lunar regolith is derived. Apollo 12 rocks have concentrations of Zn, Ge, Cd, In and possibly Ir which are lower by factors of 60 or more, relative to terrestrial basalts. A mechanism is proposed for the late accretion of volatile-rich materials, including comets, in which a primitive terrestrial atmosphere is invoked to explain the significantly higher concentrations of such substances on the earth. Author

N72-25755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ACCOMPLISHMENTS IN TECHNOLOGY, GODDARD SPACE FLIGHT CENTER, 1970
James M. Bridger, ed. Washington 1972 214 p refs Symp. held at Greenbelt, Md., 13 Jan. 1971
(NASA-SP-295) Avail: NTIS HC $3.00 CSCL 22A

Assessments of current developments in satellite technology are presented. Covered are such areas as communications, tracking, control, instrumentation, and orbit calculations. For individual titles, see N72-25756 through N72-25804.

N72-25756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO WAVE PROPAGATION EXPERIMENTS TO PROBE THE IONOSPHERE c07
P. E. Schmid *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 3-9 refs (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20N

Ionospheric bias corrections associated with radio tracking of spacecraft depend on the following measuring techniques for integrated electron content: (1) Faraday rotation measurements from an earth synchronous satellite; (2) ranging measurements at two frequencies; and (3) group and phase velocity measurements obtained from tracking data. The extraction of the integrated electron content directly from tracking data is achieved by comparison of range-rate measurements based on Doppler shift with differentiated range measurements based on tone delay. This method is most desirable because the measured corrections pertain directly to the spacecraft whose orbit is being determined and can be used in near earth as well as deep space tracking data. G.G.

N72-25757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF SATELLITE THEORIES c31
H. G. Hertz *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 10-13 refs (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22A

The accuracy of five mathematical models in computing a nominal orbit for the Vanguard 2 satellite by using a position velocity vector is considered. Either numerical integration or analytical theories are used in all models as well as the same force model that corresponds to a potential with the zonal harmonics to order four. The amounts of spread in the values of the total energy and the z-component of the angular momentum for a set of times are considered as measures of accuracy. G.G.

N72-25758*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ANALYSIS OF THE EXPECTED ECCENTRICITY PERTURBATIONS FOR THE SECOND RADIO ASTRONOMY EXPLORER (RAE B) c31
James P. Murphy *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 14-17 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22A

Analytical prediction of expected eccentricity perturbations for the RAE 2 lunar orbit shows that the eccentricity will grow linearly in time. Parametric inclination studies and analysis of perturbation equations establish a critical retrograde inclination of 116.565 at which the positive perturbation slope vanishes for a circular orbit about 1100 m above the lunar surface with an eccentricity constraint of less than 0.005 during a period of about one year. G.G.

N72-25759*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICAL IN-ORBIT BEHAVIOR OF THE RADIO ASTRONOMY EXPLORER SATELLITE c31
Harvey Walden *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 18-22 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22A

Onboard sensors and associated ground based processing systems are used to maintain a well-stabilized attitude for the RAE 1 in its near circular earth orbit despite the satellite's four extremely long and flexible antenna booms. Boom tip deflection pictures and central hub orientation measurements show that large boom vibrations and major attitude stability problems anticipated prior to launch have not materialized. G.G.

N72-25760*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FUTURE TECHNIQUES FOR TRACKING OF SYNCHRONOUS SATELLITES
James L. Cooley *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 23-25 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22A

A tracking system error analysis computer program is reported to study the feasibility of using range sum and range-rate sum measurements through a synchronous satellite to a user satellite, and range sum and range-rate sum measurements through a synchronous satellite to a ground based transponder for tracking of synchronous satellites. Error analysis transformed noise, bias, ground station location and orbit uncertainties into expected uncertainties in each of the orbits after tracking. Results show that both of the proposed measurement methods are feasible for determining and refining the orbits of future synchronous satellites. G.G.

N72-25761*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOPOTENTIAL AT SYNCHRONOUS-ORBIT ALTITUDES c13
C. A. Wagner *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 26-29 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 08N

The earth's gravity potential at synchronous orbit satellite altitudes is studied by analyzing the small effects of the resonant harmonic of gravity in tracking data from eight satellites during 21 distinct drift-free arcs. Results show: (1) absolute accuracy of second degree resonant geopotential coefficients better than three percent and coefficients through fourth degree better than 15 percent; (2) positions of equilibrium points for geostationary satellites better than 1/2 degree; and (3) accuracy in predicting orbits for 24-hour satellites better than 1 degree for periods greater than 2 years. G.G.

N72-25762*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-ORBIT FLEXIBLE SPACECRAFT DYNAMICS PROGRAM c31
Joseph V. Fedor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 30-35 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22C

A continuous flexible body nonlinear dynamics computer program is used for simulating the spinning mode performance of a spacecraft under applied control torques. The program takes into account the continuous flexible nature of the antennas by representing deflections in terms of shape functions and integrated the spatial dependence in the formulation of the equations of motion. Comparison of RAE flight data on roll, pitch, and yaw with predictions of the computer program in the gravity gradient mode show fair to good agreement in roll and pitch and excellent agreement in the yaw angle. G.G.

N72-25763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRUCTURAL-THERMAL-OPTICAL PROGRAM (STOP) c32
H. P. Lee *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 36-40 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20K

A structural thermal optical computer program is developed

which uses a finite element approach and applies the Ritz method for solving heat transfer problems. Temperatures are represented at the vertices of each element and the displacements which yield deformations at any point of the heated surface are interpolated through grid points. G.G.

N72-25764*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-DIMENSIONAL FINITE-ELEMENT TEMPERATURE VARIANCE ANALYSIS **c33**
J. S. Heuser *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 41-44 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20M

The finite element method is extended to thermal analysis by forming a variance analysis of temperature results so that the sensitivity of predicted temperatures to uncertainties in input variables is determined. The temperature fields within a finite number of elements are described in terms of the temperatures of vertices and the variational principle is used to minimize the integral equation describing thermal potential energy. A computer calculation yields the desired solution matrix of predicted temperatures and provides information about initial thermal parameters and their associated errors. Sample calculations show that all predicted temperatures are most effected by temperature values along fixed boundaries; more accurate specifications of these temperatures reduce errors in thermal calculations. G.G.

N72-25765*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A ROTARY ACTUATOR FOR SPACE MISSIONS **c15**
E. J. Devine *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 45-47 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 13I

A new rotary actuator is reported that consists of a motor functionally integrated with the transmission of a ring gear in a single element which is driven by the rotating magnetic vector in the stator. Because the number of teeth on the ring gear is different from that on the fixed ground gear, the ring gear rotates at a fraction of a revolution and simultaneously rotates the output gear in one eccentric cycle in the opposite direction. The advantages of the design are that only two bearings are required on a low speed output shaft. G.G.

N72-25766*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYBRID CIRCUIT MODULES FOR MOTOR COMMUTATION AND CONTROL **c09**
C. deKramer *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 48-51 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09A

Thick film hybrid techniques are used to develop circuitry for a brushless dc motor commutator. The power commutator contains the driving circuit and an amplifier that controls the armature current. A position decoder contains digital integrated circuits which receive the signals from the armature position sensors and generate the driving signals for the power commutator in the proper sequence. These units drive motors with stall currents up to about 400 mA. G.G.

N72-25767*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATICALLY ACTIVATED, 300 AMPERE-HOUR SILVER-ZINC CELL **c03**
Thomas J. Hennigan *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 52-55 ref (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 10C

A prototype silver zinc cell is reported for which the electrolyte is being stored in a separate tank; the cell is being activated when additional power is required by collapsing the neoprene bellows container and thus forcing the electrolyte into cell through a plastic connection. A solar array is proposed as main power source for the flow actuator. G.G.

N72-25768*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCREENING AND SELECTION OF NICKEL AND CADMIUM CELL PLATES TO IMPROVE UNIFORMITY **c03**
Gerald Halpert *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 56-58 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 10C

A weight screening method for nickel and cadmium cell plates is used to predict plate-capacity relationships nondestructively before assembly. Plates are physically and chemically characterized and subjected to electrochemical capacity tests to establish optimal plate-weight to plate-capacity ratios G.G.

N72-25769*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DEGRADATION OF ALZAK BY SHORT WAVELENGTH ULTRAVIOLET RADIATION **c23**
Martin J. Donohoe, Roy McIntosh, Jr., and John H. Henninger *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 59-66 refs (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20M

The changes in reflectance of thermal aluminum coating samples exposed to different irradiating utraviolet wavelengths are discussed. It is shown that the coating is damaged faster and further by 180 to 210 in radiation than by Lyman alpha radiation. On an equivalent incident energy basis, Lyman alpha does less damage than 180 to 210 nm radiation. Above 300 nm no degradation is observed for long exposures and below 300 nm increasing degradation with decreasing wavelength is found. It is concluded that Lyman alpha radiation need not be included in laboratory testing of this thermal coating for spacecraft structures. G.G.

N72-25770*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT RADIATION ANALYSIS **c24**
Dale W. Harris *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 67-70 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 18D

The radiation interface in spacecrafts using radioisotope thermoelectric generators is studied. A Monte Carlo analysis of the radiation field that includes scattered radiation effects, produced neutron and gamma photon isoflux contours as functions of distance from the RTG center line. It is shown that the photon flux is significantly depressed in the RTG axial direction because of selfshielding. Total flux values are determined by converting the uncollided flux values into an equivalent RTG surface source and then performing a Monte Carlo analysis for each specific dose point. Energy distributions of the particle spectra completely define the radiation interface for a spacecraft model. G.G.

N72-25771*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 10, 6-MICROMETER LASER RECEIVER RF SUBSYSTEM **c16**
D. E. Santarpia *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 71-73 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

A simplified laser receiver carrier tracking loop is described. The laser carrier is optically mixed with a locally generated 10.6 micrometer signal, thereby translating the received signal to an IF signal that varies between dc and GHz. This signal is fed to a second order carrier tracking loop that contains a transistor LC oscillator tuned by a varactor over a 1 GHz range; transistor shunt capacitance increases the upper frequency bound of the oscillator in a high Doppler environment. G.G.

N72-25772*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

Ku-BAND HIGH GAIN ANTENNA c07

Leonard F. Deerkoski *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 74-78 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 17B

An exposed four element array of 12.8 m diameter elements mounted on a common pedestal is the recommended ground antenna configuration in support of the 2 GHz bandwidth Ku-band downlink from tdr satellites. The array provides three channel phase monopulse tracking capability with only listening feeds in each element. The array is as cost effective as a single aperture antenna and offers significant advantages in tracking and reliability. Author

N72-25773*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DISCRETE COMPONENT S-BAND POWER AMPLIFIER c09

Arthur F. Block *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 79-81 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 09E

A spacecraft S-band power amplifier for Nimbus satellite is reported that achieves stability by use of moderate Q input and output circuits. The discrete component amplifier uses distributed inductance and small piston capacitors for resonance and impedance matching of the transistor to 50 ohm input and output. G.G.

N72-25774*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FLIGHT DATA SYSTEMS USING LSI P-CHANNEL MOSFETS c10

James H. Trainor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 82-86 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 09C

Continuing development and expansion of a series of P-channel MOSFET circuits in flight data systems is reported. Using hybrid thick film techniques, these circuits evolved into bugs with more than 1000 transistors on a chip. A proposed data system for Helios satellite will have approximately 130 bugs and a semiconductor count of more than 100,000, will weigh less than 1 N and use less than 1.2 W. G.G.

N72-25775*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TELEMETRY REMOTE MODULES c07

J. R. Silverman *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 87-89 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 09F

A fully operational engineering telemetry remote module is reported that forms the basis for a decentralized telemetry system which employs small low powered modules capable of distributing the multiplexer input gates around a spacecraft. The module operates mainly as a harness reducer, allowing data to be transmitted back to a central control core for inclusion in the telemetry bit stream. Each unit is capable of accepting 32 data points in various combinations. G.G.

N72-25776*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN ONBOARD PROCESSOR (OBP) FOR OAO C c08

Raymond Hartenstein *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 90-95 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 09B

A stored program computer and its application on OAO is considered. The parallel computer has a memory capacity of 16,384 words of 18 bits each, one central processor unit, two 4096 word memory units, and one input/output unit. The I/O has no direct data connection with the CPU so that all data flow between these two units must pass through memory by way of the memory data bus. The primary functions of the onboard computer are auxiliary command storage, spacecraft monitoring and malfunction reporting, data compression and status summary, and possible performance of emergency corrective action. G.G.

N72-25777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE NIMBUS 4 IRLS METEOROLOGICAL EXPERIMENT c20

Charles E. Cote *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 96-99 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 04B

The Nimbus 4 interrogation, recording, and location system is designed to locate and collect measurement data of upper atmospheric parameters through the tracking of free floating, constant level balloons flying at altitudes of 20.5 and 24.1 km and carrying specially designed interrogation packages. The basic elements of the system include a ground acquisition and command station, the Nimbus satellite, and the remote sensing platforms. Addresses of platforms as they come into view are programmed into the satellite on an orbit by orbit basis from the central ground station. Sensory data are transmitted to the satellite for storage and readout from balloon interrogation units. G.G.

N72-25778*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MILLIMETER WAVE PROPAGATION MEASUREMENTS USING THE ATS 5 SATELLITE c07

Louis J. Ippolito *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 100-102 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 20N

The ATS 5 millimeter wave propagation experiment determines long- and short-term attenuation statistics of operational millimeter wavelength earthspace links as functions of defined meteorological conditions. A preliminary analysis of results with 15 GHz downlink and 32 GHz uplink frequency bands indicates that both frequency bands exhibit an excellent potential for utilization in reliable high data rate earth-space communications systems. G.G.

N72-25779*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GLANCING INCIDENCE TELESCOPES FOR SPACE ASTRONOMY c14

John D. Mangus *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 103-106 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 17H

Design optimization is reported for glancing telescopes of increased collecting areas. Considered are nested geometries for X-ray and extreme ultraviolet telescopes, each of which generates only one singular principal surface. In the case of the X-ray telescope, the field curvature of the outer telescope serves as a standard and the focus of each of the inner telescopes is made coplanar by a slight descrease in the collecting area of each of the inner telescopes. In the case of the EUV telescope, a slight change in the maximum slope angle of the inner telescope makes the field curvatures coincide. Five concentric X-ray telescopes form a collecting area of approximately 900 sq cm, and a nested EUV telescope consisting of two concentric telescopes produces a collecting area of about 45 sq cm. G.G.

N72-25780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A COMPUTER PROGRAM TO EVALUATE OPTICAL SYSTEMS c08

Daphne Innes *In its* Significant Accomplishment in Technol., GSFC, 1970 1972 p 107-110 (See N72-25755 16-30)

Avail: NTIS HC $3.00 CSCL 09B

A computer program is used to evaluate a 25.4 cm X-ray telescope at a field angle of 20 minutes of arc by geometrical

analysis. The object is regarded as a point source of electromagnetic radiation, and the optical surfaces are treated as boundary conditions in the solution of the electromagnetic wave propagation equation. The electric field distribution is then determined in the region of the image and the intensity distribution inferred. A comparison of wave analysis results and photographs taken through the telescope shows excellent agreement. G.G.

N72-25781*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL IMAGE DISSECTOR CAMERA SYSTEM c14
Bernard L. Johnson *In its* Significant Accomplishment in Technol., GSFC, 1970 1972 p 111-114 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14E

A sensor system which provides registered high-solution multispectral images from a single sensor with no mechanical moving parts is reported, and the operation of an image dissector camera (IDC) is described. An earth scene 100 nautical miles wide is imaged through a single lens onto a photocathode surface containing three spectral filters, thereby producing three separate spectral signatures on the photocathode surface. An electron image is formed, accelerated, focused, and electromagnetically, deflected across an image plane which contains three sampling apertures, behind which are located three electron multipliers. The IDC system uses electromagnetic deflection for cross-track scanning and spacecraft orbit motion for along-track scanning, thus eliminating the need for a mechanical scanning mirror. Author

N72-25782*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRECISION DIGITAL SOLAR ASPECT SENSOR c14
H. P. Scherer *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 115-118 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

The development of a digital solar aspect sensor with a resolution of approximately 14 arc-seconds is discussed. An interpolation technique was used to generate the fine angle measurements. The sensor and its mode of operation are described. The electronic and mechanical design of the sensor were completed, and two flight units, one for the OAO 4 and the other for determining the attitude of a spinning spacecraft, are being fabricated. K.P.D.

N72-25783*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ADAPTIVE NARROW BAND FREQUENCY MODULATION VOICE COMMUNICATION SYSTEM c07
Sheldon Wishna *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 119-121 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

A narrow band frequency modulation communication system is described which provides for the reception of good quality voice at low carrier-to-noise ratios. The high level of performance is obtained by designing a limiter and phase lock loop combination as a demodulator, so that the bandwidth of the phase lock loop decreases as the carrier level decreases. The system was built for the position location and aircraft communication equipment experiment of the ATS 6 program. Author

N72-25784*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER-AIDED CO2 LASER CAVITY-LENGTH SELECTION FOR REDUCED LINE COMPETITION c16
G. Schiffner *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 122-125 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

The advantages of carbon dioxide lasers for space communications systems are considered. An attempt was made to predict the signature of CO2 lasers. It was found that this requires accurate data on the laser wavelengths (accuracy on the order of 10 MHz). The results of absolute frequency measurements of CO2 lines were utilized, and a list of accurate frequencies was calculated. A computer program was written for the signature prediction. A second program was written which searches through large ranges of cavity length and prints lists of regions where a particular line is well separated from adjacent lines in the signature. Lasers designed according to this list will have an undisturbed tuning profile for one or more lines. K.P.D.

N72-25785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS OF FM-TV THRESHOLD REDUCTION INVESTIGATION FOR THE ATS F TRUST EXPERIMENT c07
James P. Brown *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 126-128 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

An investigation of threshold effects in FM-TV was initiated to determine if any simple, low cost techniques were available which can reduce the subjective video threshold, applicable to low cost community TV reception via satellite. Two methods of eliminating these effects were examined: the use of standard video pre-emphasis, and the use of an additional circuit to blank the picture tube during the retrace period. K.P.D.

N72-25786*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION DAMAGE EFFECTS ON SOLID STATE DETECTORS c24
James H. Trainor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 129-132 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 18H

Totally depleted silicon diodes are discussed which are used as nuclear particle detectors in investigations of galactic and solar cosmic radiation and trapped radiation. A study of radiation and chemical effects on the diodes was conducted. Work on electron and proton irradiation of surface barrier detectors with thicknesses up to 1 mm was completed, and work on lithium-drifted silicon devices with thicknesses of several millimeters was begun. K.P.D.

N72-25787*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REVISED STANDARDS FOR THE SOLAR CONSTANT AND THE SOLAR SPECTRUM
M. P. Thekaekara *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 133-137 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 03B

The values of the solar constant and solar spectrum are presented which are proposed as revised standards for science and technology. A solar constant value of 1.94 cal/sq cm min or 135.3 mW/sq cm was proposed. A detailed spectral irradiance table is given for the range of 0.12 to 1000 microns. K.P.D.

N72-25788*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER PROGRAM TO AUTOMATE RESIDUAL GAS ANALYSIS c08
H. Shapiro *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 138-239 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09B

A computer program for automatic determination of gases found in an environmental chamber during spacecraft testing is discussed. Program testing is reviewed. The program is being used for the solution of experimental spectra, where the mass spectrometer is used as a contamination monitor by an untrained spectroscopist. K.P.D.

N72-25789*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL THERMAL MECHANICS OF DEPLOYABLE BOOM STRUCTURES **c33**
Roamer Predmore *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 140-144 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20M

An apparatus was developed for thermal distortion measurements on deployable boom structures. The calibration procedure and thermal static bending plus twist measurements are considered. The thermal mechanics test facility is described. A table is presented for several examples of spacecraft applications of thermal static distortion measurements on 3-m deployable booms. K.P.D.

N72-25790*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN AND DEVELOPMENT OF A MICROPOUND EXTENDED RANGE THRUST STAND (MERTS) **c14**
Kenneth W. Stark *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 145-147 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

The development and operation of a micropound extended range thrust stand are considered. A cesium ion engine was tested in order to determine the measurement accuracy of the apparatus and to verify the calibration techniques used. The ion engine was tracked to within 5 percent. A check of the thrust stand calibration factor against that of the ion engine calibration factor showed a 4.3 percent difference. K.P.D.

N72-25791*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRA-PRECISE ATTITUDE TEST FACILITY FOR FLIGHT SPACECRAFT **c11**
E. J. Devine *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 148-151 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

A test facility was designed and built for conducting complete dynamic systems tests of the OAO spacecraft. The operating principle of the facility is illustrated for a single control axis. The test facility is described which was built and used to test the stabilization and control system of the OAO B spacecraft. Fine pointing of the spacecraft was demonstrated to better than 0.5 seconds of arc. Other spacecraft functions tested were gimbaled and boresight star tracker operations, coarse and fine slew maneuvers, inertial guidance operation, settling time of the spacecraft control system, and transfers between all modes of control. K.P.D.

N72-25792*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPROVED LASER RANGING ACCURACY THROUGH DYNAMIC THRESHOLD COMPENSATION **c16**
T. S. Johnson *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 152-155 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

During a polar motion experiment (in which two laser ranging systems on a north-south line simultaneously tracked a satellite to determine motion of the pole), techniques for improving both the range noise and range bias were demonstrated. The corrections to the measured ranges (based on received signal levels relative to a fixed correction that would have been applied if pulse height information was not available) are given. It was shown that even existing long pulse systems (20 to 40 nsec duration) can be improved to the 20 to 30 cm level of precision without major or expensive changes to the system. K.P.D.

N72-25793*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STADAN ANTENNA GAIN CALIBRATION USING RADIO STARS **c07**
Ralph E. Taylor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 156-158 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

An antenna gain measurement method was developed which utilizes a signal emitted from a radio star to determine absolute antenna gain at 136 MHz and 400 MHz for antennas in the STADAN network. An error analysis of the radio star method shows that the overall standard deviation uncertainty in antenna gain is + or - 0.6 db (1 sigma). K.P.D.

N72-25794*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTER CONTROLLED ANTENNA SYSTEM **c07**
Nicholas A. Raumann *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 159-162 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17I

Digital techniques are discussed for application to the servo and control systems of large antennas. The tracking loop for an antenna at a STADAN tracking site is illustrated. The augmentation mode is also considered. K.P.D.

N72-25795*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DICHRONIC SUBREFLECTOR FOR ROSMAN 2 **c07**
Julius A. Kaiser *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 163-166 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

The dichronic subreflector for the Rosman 2 dish antenna is described. Tests were conducted to make focusing adjustments, to measure the system parameters indicative of a focused condition for the Cassegrain feed, and to determine losses for the focal point feeds due to the presence of the dichroic. K.P.D.

N72-25796*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNAL COHERENCE STUDIES IN MULTIAPERTURE ARRAYS **c07**
Leonard F. Deerkoski *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 167-170 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 17B

A two-element array was constructed to measure the gain improvement that can be realized while tracking spacecraft. Measurements were made at VHF and S band. An automatically controlled time delay correction system was developed and tested for this program. K.P.D.

N72-25797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NAS-PAK LOGIC SYSTEM **c07**
James Billingsley *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 171-180 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09F

The design and fabrication of telemetry ground data processing equipment using commercial logic cards or modules are discussed. A microelectronics program was initiated to evaluate circuitry, packaging methods, and fabrication approaches necessary to produce a competitively procured logic system. The NAS-PAK logic system covering all phases of implementation is considered. K.P.D.

N72-25798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULATION OF MASS STORAGE SYSTEMS OPERATING IN A LARGE DATA PROCESSING FACILITY **c08**
Richard Holmes *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 181-182 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 09B

A mass storage simulation program was written to aid

system designers in the design of a data processing facility. It acts as a tool for measuring the overall effect on the facility of on-line mass storage systems, and it provides the means of measuring and comparing the performance of competing mass storage systems. The performance of the simulation program is demonstrated. K.P.D.

N72-25799*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FEASIBILITY MODEL OF A VIDEO INSTRUMENTATION RECORD/REPRODUCE SYSTEM c14
J. L. Tinsley *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 183-186 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14B

A developmental model of an instrumentation video record/reproduce system for STADAN, ERTS, and Goddard Space Flight Center is discussed. Performance evaluations of three present-day systems and the model are presented. K.P.D.

N72-25800*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATED DETECTION OF BACTERIA IN URINE c05
Albert J. Fleig, Grace L. Picciolo, Emmett W. Chappelle, and Burton N. Kelbaugh *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 188-192 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 06B

A method for detecting the presence of bacteria in urine was developed which utilizes the bioluminescent reaction of adenosine triphosphate with luciferin and luciferase derived from the tails of fireflies. The method was derived from work on extraterrestrial life detection. A device was developed which completely automates the assay process. K.P.D.

N72-25801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HEART SOUND PREPROCESSOR c05
Wayne T. Chen *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 193-195 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 06B

Technology developed for signal and data processing was applied to diagnostic techniques in the area of phonocardiography (pcg), the graphic recording of the sounds of the heart generated by the functioning of the aortic and ventricular valves. The relatively broad bandwidth of the PCG signal (20 to 2000 Hz) was reduced to less than 100 Hz by the use of a heart sound envelope. The process involves full-wave rectification of the PCG signal, envelope detection of the rectified wave, and low pass filtering of the resultant envelope. K.P.D.

N72-25802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG RANGE LASER TRAVERSING SYSTEM c16
Louis O. Caudill *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 196-198 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20E

A study was carried out to determine the feasibility of a man-portable receiver system for land survey, which would be capable of detecting the optical scatter due to molecular and aerosol constituents of the atmosphere from a vertical laser beam. Tests were run with a beacon and receiver separated by approximately one mile. The system was consistently able to detect the laser signal regardless of background conditions. K.P.D.

N72-25803*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
USING THE SCANNING ELECTRON MICROSCOPE ON THE PRODUCTION LINE TO ASSURE QUALITY SEMICONDUCTORS c15
John W. Adolphsen and Robert J. Anstead *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 199-202 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 14D

The use of the scanning electron microscope to detect metallization defects introduced during batch processing of semiconductor devices is discussed. A method of determining metallization integrity was developed which culminates in a procurement specification using the scanning microscope on the production line as a quality control tool. Batch process control of the metallization operation is monitored early in the manufacturing cycle. K.P.D.

N72-25804*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAPRECISION TOOL POSITIONER c15
Ewald E. Schmidt *In* Its Significant Accomplishments in Technol., GSFC, 1970 1972 p 203-205 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 13I

A linear actuator was designed with a range of several centimeters plus. Two independently functioning devices were combined to form a tool positioner, which could be used for the generation of optical elements in highly stable materials or to actively control the figure of a lightweight astronomical mirror. The advantages of the positioner over other displacement actuators are: simplicity of construction, large displacement range, bidirectional displacement, and the ability to work against opposing forces. An engineering model positioner was manufactured and tested. The system includes an electronic switching circuit and a laser interferometer gage. It was demonstrated that, by combining a holding and a driving mechanism, the capabilities of a limited positioning device are extended. K.P.D.

N72-25805# Colorado Univ., Boulder.
[SOLAR PHYSICS, PLANETARY ATMOSPHERES, AND SPACE ASTRONOMY] Annual Report, 1970 - 1971
Jun. 1971 55 p ref
Avail: NTIS HC $4.75

Space research activities and research techniques are reported. Resonance line profiles of the sun were obtained on rockets, and a high resolution scanning spectrometer for OSO I is being built. Ultraviolet spectra of Mars obtained by Mariners 6 and 7 were studied and the results are summarized, and ultraviolet photometric data on hydrogen and oxygen radiations from the earth's upper atmosphere, taken aboard OGO 5 and 6, are mentioned. Space astronomy activities are reviewed, and ultraviolet observations of two bright comets reveal that they are almost entirely made of water ice, are much larger than previously believed, and have a cloud of hydrogen gas millions of miles in diameter surrounding the comet head. Visible and ultraviolet spectra of the earth's aurora were also observed, and the morphology of particle precipitation was studied at Byrd station, Antarctica, to provide data on solar wind-magnetosphere-ionosphere coupling. Laboratory and computer analyses in support of theoretical considerations are outlined, and a special purpose computing facility is mentioned. Rocket and satellite instrumentation is also described. N.E.N.

N72-25806# National Environmental Satellite Center, Washington, D.C.
SATELLITE ACTIVITIES OF NOAA 1971
Apr. 1972 15 p
Avail: NTIS HC $3.00

Ocean and weather observations by satellites, and supporting activities by research laboratories and data processing facilities are presented for 1971. N.E.N.

N72-25807# National Bureau of Standards, Washington, D.C.
A MULTIPLE TABLE OF ASTROPHYSICAL INTEREST. PART 1: TABLE OF MULTIPLETS. PART 2: FINDING LIST OF ALL LINES IN THE TABLE OF MULTIPLETS

Charlotte E. Moore Feb. 1972 260 p refs *Its* Contrib. from Princeton Univ. Obs. no. 20, 1945
(NSRDS-NBS-40; LC-79-179666) Avail: SOD $2.00 as SD 13.48:40

Pending the completion of a current edition, the 1945 Multiplet Table is reprinted. The leading lines in 196 atomic spectra of 85 chemical elements are listed in related groups called multiplets. Estimated intensities, excitation potentials, and multiplet designations are given for the individual lines, and each multiplet is assigned a number. The table is presented in two parts: Part 1 includes the multiplets, with the spectra of each element being given in order of increasing ionization, and the elements in order of increasing atomic number. Part 2 is a finding list in which all the lines in Part 1 are entered in order of increasing wavelength, with their multiplet numbers. The range of the table is from 2951 A to 13164 A. A supplementary table of forbidden lines extends from 2972 A to 12645 A. Author

N72-25808*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
METEOR RESEARCH PROGRAM Semiannual Technical Report, 1 Jul. - 31 Dec. 1969
R. B. Southworth and R. E. McCrosky Jul. 1970 25 p refs
(Grant NSR-09-015-033)
(NASA-CR-112639; SATR-8) Avail: NTIS HC $3.25 CSCL 03B

An overview of research on radio and radar meteors accomplished during the past decade is presented, and the work of the past year is highlighted. Velocity distribution and mass flux data are obtained for meteors in the range 10 to 0.0001 g, the size believed to be the principal hazard to space missions. The physical characteristics of mass, structure and density, luminosity, and ablation are briefly described, and the formulation of a theory for interactions of ionization and excitation during collision of atomic particles is mentioned. Five classes of meteoroids are identified, including the two of iron and stone meteorites. Stream meteors associated with known comets are Classes A or C, and parent comets of Class B streams are not observed. Class A meteoroids are identified with the core of a cometary nucleus, Class C with less dense surface of the nucleus after sublimation of ices, and Class B with less dense cores of smaller cometary nuclei. Atmospheric meteor phenomena associated with winds and gravity waves, density and temperature, atomic oxygen, and meteor rate changes are mentioned. N.E.N.

N72-25809*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONJUGATE GRADIENT DETERMINATION OF OPTIMAL PLANE CHANGES FOR A CLASS OF THREE-IMPULSE TRANSFERS BETWEEN NONCOPLANAR CIRCULAR ORBITS
Roger R. Burrows 3 Mar. 1972 29 p refs
(NASA-TM-X-64662) Avail: NTIS HC $3.50 CSCL 22C

A particular type of three-impulse transfer between two circular orbits is analyzed. The possibility of three plane changes is recognized, and the problem is to optimally distribute these plane changes to minimize the sum of the individual impulses. Numerical difficulties and their solution are discussed. Numerical results obtained from a conjugate gradient technique are presented for both the case where the individual plane changes are unconstrained and for the case where they are constrained. Possibly not unexpectedly, multiple minima are found. The techniques presented could be extended to the finite burn case, but primarily the contents are addressed to preliminary mission design and vehicle sizing. Author

N72-25810*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHYSICS OF THE SOLAR SYSTEM
S. I. Rasool, ed. Washington 1972 519 p refs
(NASA-SP-300) Avail: NTIS; SOD $3.75 CSCL 03B

Papers are presented on the physics of the sun, planetary atmospheres, planetary interior structure, lunar soil, origin of the solar system and of the moon, and on radar and radio exploration of the planets. For individual titles, see N72-25811 through N72-25823.

N72-25811*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTRODUCTION TO SOLAR PHYSICS
J. C. Brandt *In its* Phys. of the Solar System 1972 p 1-22 (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

The basic physics involved in the large-scale structure of the solar interior and atmosphere is reviewed. The solar mass, mean radius, differential rotation, luminosity, and age are listed. The main physical properties of the following zones are described: (1) the energy producing interior; (2) the hydrogen convection zone with high opacity and short mean free path for photons; (3) the thin radiative photosphere which emits most of the photons; (4) the chromosphere with thickness up to 10,000 km and temperature up to 1 million K; and (5) the tenuous outer corona which becomes the solar wind on expansion. N.E.N.

N72-25812*# Princeton Univ., N.J. Joseph Henry Labs.
INTERNAL ROTATION OF THE SUN
R. H. Dicke *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 23-60 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

Oblateness observations and other data having a bearing on deep solar interior rotation are discussed. (1) Photospheric oblateness was observed with a specially designed telescope, and the oblateness value was determined to be 0.00005, to be independent of color, and to have unimportant contributions from the chromosphere and corona. The effective photospheric temperature is nearly free of latitudinal variation. (2) The rotation of the core is fixed by the observed oblateness, assuming that the oblateness implies a gravitational quadrupole moment due to a rapidly rotating solar interior. (3) Dynamically driven spin-down currents do not occur in the interior because of strong density stratification and the slow braking by solar wind. (4) The solar wind structure suggests a present solar wind torque density at the equator of 100 million dyne/cm. (5) The lithium depletion and lack of beryllium depletion in the sun indicate a rapidly rotating core between 0.5 and 0.58 solar radii. N.E.N.

N72-25813*# Columbia Univ., New York.
A HISTORY OF SOLAR ROTATION
E. A. Spiegel *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 61-87 refs (See N72-25810 16-30)
(Grant NSF GP-18062)
Avail: NTIS; SOD $3.75 CSCL 03B

The evolution of the solar rotation rate from an assumed initial state of rigid rotation at the end of the Hayashi phase is discussed. The rotation rates of stars in clusters are considered and the reasons why the rate decreases with age are investigated. The dynamics of the powerful convective zones in the outer layers of stars with a surface temperature of approximately 8000 K or less is described. Angular momentum, the radial component of magnetic field at the surface, spin-down, solar wind, and their connection with the braking of solar rotation are considered. The spin-down process is illustrated with the tea cup model and a sun-like cylinder. The instabilities in the sun are discussed, and it is suggested that the first to appear is the inflection point instability and the seat of instability is in the tachycline. It is pointed out that in considering the solar spin-down problem, the lithium problem, the solar magnetic fields, and the helium mixing must be included. N.E.N.

N72-25814*# Los Alamos Scientific Lab., N.Mex.
DYNAMICS OF THE OUTER SOLAR ATMOSPHERE
A. J. Hundhausen *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 89-153 refs Sponsored

by AEC (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

The dynamic processes which produce the corona and its expansion into interplanetary space, the resulting relationship between solar and interplanetary phenomena, and the use of interplanetary observations to infer coronal properties are discussed. Pertinent properties of the corona, chromosphere, transition region, and interplanetary medium are given. Hydrodynamics and thermodynamics of the outer atmosphere are considered, emphasizing the energy source terms and their influence on the atmospheric regions, the mechanical heat dissipation term, and atmospheric heating by acoustic waves. Details are given on the quantitative models of expansion in the region where mechanical dissipation becomes negligible and in an interplanetary zone where the energy flux is entirely due to convection. Two models relating interplanetary, coronal, and photospheric ionic abundances are presented, one based on the abundance of helium and the other on the ionization state of the expanding corona and stressing oxygen ions. The propagation through the solar wind of spherically symmetric shock waves produced by solar flares and the energy released by the flares are also investigated. N.E.N.

N72-25815*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INTERPLANETARY PLASMA
K. Ogilvie *In its* Phys. of the Solar System 1972 p 155-195 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

Plasma diagnostic techniques are described and observations of the interplanetary plasma are discussed. The properties of interplanetary and interstellar plasmas are constrasted with the solar corona plasma and the laboratory Q-plasma and thermonuclear plasma. The relative abundances and relative populations of charge states in the solar wind are given for hydrogen, helium, oxygen, and carbon ions, along with the distribution of flux with energy per unit charge for a hypothetical solar wind. Details are presented on solar wind observations during normal and disturbed times. Bulk speed of the solar wind, the earth's bow shock, interplanetary magnetic field, interplanetary shock waves, and the effects of solar flares are discussed. Explorer 34 data are emphasized, and observations by Mariner 5, Pioneer 8, and other probes are also included. N.E.N.

N72-25816*# Kitt Peak National Observatory, Tucson, Ariz.
LOWER ATMOSPHERES OF THE PLANETS
Donald M. Hunten *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 197-241 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

The composition, thermal structure and radiative heat transfer, and density of planetary lower atmospheres are discussed, emphasizing Mars, Venus, and Jupiter. Equations for equilibrium temperatures, integrated densities, and the pressure, density, and temperature relations are given. The Mars atmosphere is thin, has few clouds, is predominantly carbon dioxide, and its motions are determined by surface temperatures. Mariner 4, 6, and 7 data are used as well as earth-based data. The main feature of the Venus atmosphere is the cloud cover and the major gas is carbon dioxide; the high surface temperature and cloud composition are discussed. Observations by Mariner 5 and Veneras 4, 5, and 6 are described. The Jupiter atmosphere is dominated by clouds of ammonia ice, has infrared hot spots, and the gas is mainly molecular hydrogen. Ammonia absorption is probably absent on Saturn and is certainly absent on Uranus and Neptune; methane absorptions are strong, and molecular hydrogen absorptions should also be strong. Mercury's atmosphere is expected to have O, H2O, CO2, CO, and Ar. N.E.N.

N72-25817*# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
THE COMPOSITION OF PLANETARY ATMOSPHERES
Tobias Owen *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 243-267 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

The compositions of the atmospheres of planets, satellites, and comets are discussed, and abundances of some of the constituents are determined from absorption spectra. Data are given indicating that Jupiter's atmosphere is identical to that of the Sun, and observations of the Great Red Spot and the North Equatorial Belt are described. Saturn's atmosphere contains computable amounts of hydrogen and methane, its satellite Titan has a methane atmosphere, and spectra indicate that the Saturn rings have particles partially coated with ice. The spectra of Uranus and Neptune are dominated by methane absorption bands, and both planets exhibit pressure-induced dipole bands of hydrogen. The atmospheres of Venus and Mars contain over 90% carbon dioxide, and the amounts of detected water are indicated. Cometary spectra suggest that the molecular emission lines arise from radicals such as C2, C3, CN, and OH; the cometary composition is similar to that exhibited by Uranus and Neptune, and the observed radicals are identical to those observed in interstellar space. Recent observations of the Tago-Sato-Kosaka and Bennett comets are discussed. N.E.N.

N72-25818*# Princeton Univ., N.J.
INTERIOR STRUCTURE OF GIANT PLANETS
R. Smoluchowski *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 269-294 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

Recent developments in the study of the interior structures of Jupiter and the other giant planets are presented, and theoretical methods are reviewed. Basic models of Jupiter are outlined and include the classical De Marcus model, and those based on physico-chemical analysis of H-He equilibrium and on thermal structure. Jupiter emits about 2.7 times more radiation than it receives, and the possible sources of the excess (natural radioactivity, nuclear reactions, change in gravitational constant, primordial heat, and gravitational shrinkage) are discussed. Internal convection and the many puzzling problems presented by the Red Spot are considered. Saturn's interior is qualitatively similar to that of Jupiter, except that the phase change between molecular and metallic solid hydrogen occurs at a smaller radius and the helium-rich central core has a larger radius. Calculated radii, densities, compositions, and other physical parameters are given for Uranus and Neptune. N.E.N.

N72-25819*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADAR AND RADIO EXPLORATION OF THE PLANETS
Arvydas J. Kliore *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 295-349 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

The more important results achieved by passive radio, radar, and radio occultation methods are reviewed. Brightness temperatures, disk temperatures, thermal emissions, and microwave spectra, determined with the passive radio antennas, are presented. The radar may be transmitted as a continuous wave monochromatic signal or a pulsed signal. The first mode yields data on orbital motion, relative velocity, surface roughness, and the rotation rate. Time of flight measurements can be obtained from the pulsed signal echoes, and from these the range to target can be calculated. Doppler spread data are also included. Radio occultation experiments used Mariners 4, 5, 6, and 7. From these measurements data were obtained on the altitude of critical refraction, diffraction, attenuation, absorption, electron density profiles, and atmospheric pressure profiles. N.E.N.

N72-25820*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
NATURE AND INTERPRETATION OF THE APOLLO 11 LUNAR SAMPLES

J. A. Wood *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 351-407 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

Available geological information about the moon is discussed, the properties of Apollo 11 soil samples are described, and these data are interpreted in terms of the processes that could have shaped the lunar interior. Cratering, the most important mechanism in shaping the lunar surface, is examined in detail. The mechanics of individual cratering events, systems of interacting craters, crater statistics, regolith development, and the physical effects of cratering on lunar material are considered. Lunar geology as studied from earth-based telescopic and Lunar Orbiter photographs is briefly described, a simplified map indicating only the fundamentally different types of bedrock is presented, and the geological Imbrian time period is summarized. Most of the soil samples in the 1-mm to 1-cm range were found to be rock fragments. The most abundant type of rock is basalt, followed by a light colored rock in which anorthite (calcic feldspar) is the predominate mineral. These rocks, or anorthosites, make up about 5% of the soil, and are thought to come from the highlands. The implications of the anorthosite presence are discussed, and mechanisms to account for the evolution of an anorthositic crust are postulated. N.E.N.

N72-25821*# Institut d'Astrophysique, Paris (France).
ORIGIN OF THE SOLAR SYSTEM
E. Schatzman *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 409-450 refs (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

Historical theories are reviewed and two recent developments based on the primitive nebula idea are outlined. In the von Weizsacker theory, dust particles in a disk of gas rotating around the sun form vortices, and problems concerning the vortices are mentioned. In the theory of O. Yu. Schmidt, the planets are formed by accretion of matter around an initial center and accretion continues by taking matter from the nebula. The proto-sun is considered from knowledge of early stars and stellar rotation. The formation, physical conditions, and hydrogen evaporation of the primitive nebula are discussed. The McCrea and Williams treatment of the formation of primary bodies in the primitive nebula, based on the behavior of dust particles in the cloud, is reviewed. The mechanical problem of Schmidt for expressing the law of planetary distances is considered, and it is felt that as a first approximation the results are not incompatible with the law of planetary distances. Spallation and the origin of light elements are also mentioned. N.E.N.

N72-25822*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVOLUTION OF PLANETARY ATMOSPHERES
S. I. Rasool *In its* Phys. of the Solar System 1972 p 451-483 refs Submitted for publication (See N72-25810 16-30)
Avail: NTIS; SOD $3.75 CSCL 03B

Data on planetary atmospheres, including data recently acquired by space probes, are reviewed and theories on the early atmospheres and evolutionary changes to account for the present-day differences in composition are discussed. The most important mechanism by which a planet acquires an atmosphere is the capturing of gaseous atoms and molecules into the gravitational field at the time of accretion. The atmospheres are diminished by escape of light gas into space and are replenished by outgassing from the interior and volcanic eruptions. Details are given on present composition, possible early composition, and mechanisms for changes for the atmospheres of the Earth, Mars, Venus, and Jupiter. The abundances of the major volatiles and crustal elements for the Earth, Mars, and Venus are compared and the greenhouse effect is considered for each planet. Two interesting aspects of Jupiter are identified as the similarity of atmospheric composition to that of the Earth's of 4 billion years ago and the possibility of an interior source of heat almost four times more intense than the Sun at that distance. N.E.N.

N72-25823*# California Univ., Los Angeles. Dept. of Astronomy.
HISTORY OF THE LUNAR ORBIT
Peter Goldreich *In* NASA. Goddard Space Flight Center Phys. of the Solar System 1972 p 485-523 refs (See N72-25810 16-30)
(Grant NGR-05-007-002)
Avail: NTIS; SOD $3.75 CSCL 03B

Dynamic equations governing the evolution of the earth-moon system are derived and integrated back in time to determine its state at past epochs. The method is based on three time scales: short, determined by the revolution periods of the earth and moon around the sun and earth, respectively; intermediate, set by precessional motions of the moon's orbit plane and the earth's equator plane; and long, defined by the rate at which the frictional tides alter the state of the earth-moon system. The principle dynamic features of the sun-earth-moon system in the absence of tidal forces are described by precessional equations. It is shown that for each planet there is a critical distance such that a satellite orbit lying well within the distance will maintain a nearly constant inclination to the planet's equator plane; the present earth-moon distance is far greater than the critical distance. Equations of motion are presented for the slow changes in conserved quantities produced by frictionally retarded tides, the principal changes being produced by the tides raised on the earth by the moon, and smaller changes by the tides raised on the earth by the sun. Fission and capture theories of lunar origin and formation in earth orbit are mentioned. N.E.N.

N72-25824# Joint Publications Research Service, Arlington, Va.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 276
15 May 1972 56 p refs Transl. into ENGLISH from various Sino-Soviet bloc publications
(JPRS-55985) Avail: NTIS HC $5.00

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-25825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORBIT SELECTION CONSIDERATIONS FOR EARTH OBSERVATORY SATELLITES
J. L. Cooley Apr. 1972 34 p refs Submitted for publication
(NASA-TM-X-65907; X-551-72-145) Avail: NTIS HC $3.75 CSCL 22A

All the possible circular sun-synchronous orbits for earth observatory satellites are displayed, which have orbital altitudes between 740 and 1,115 kilometers (approximately 400 to 600 nautical miles) and have either a 16, 17, or 18 day repeat cycle for the ground trace. It was found that there are 9 orbits with a 16 day repeat cycle, 17 orbits with a 17 day repeat cycle, and 7 orbits with an 18 day repeat cycle meeting the requirements. For each of these, various characteristics such as ideal ground trace patterns, swathing patterns, and daily drift are displayed. The solar elevation angle along the orbit and the change in the solar elevation angle with season are given. This presentation of general orbital characteristics has application to finding approximate orbital elements and selecting orbits for many types of earth sensing satellite missions. Author

N72-25826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STABILITY OF ROTATING MAGNETIC STARS AND PLANETS AS JUPITER AND THE ORIGIN OF CONVECTIVE MOTION
Kunitomo Sakurai Jun. 1972 13 p refs
(NASA-TM-X-65908; X-693-72-158) Avail: NTIS HC $3.00 CSCL 03A

Based on the method of the energy principle, the effect of the coriolis force on the stability of rotating hydromagnetic systems was examined and the condition for instability was

derived. It is shown that, in rotating systems, the coriolis force inhibits the onset of convective motion and that, once the condition for instability is fulfilled, overstable states are produced with respect to this motion. Such states seem to affect the onset of turbulent convective motion. Author

N72-25827*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INFLUENCE OF LINE SHAPE AND BAND STRUCTURE ON TEMPERATURES IN PLANETARY ATMOSPHERES
Albert Arking and Kenneth Grossman (Computer Sci. Corp., New York) Jun. 1972 47 p refs Submitted for publication
(NASA-TM-X-6509; X-651-72-186) Avail: NTIS HC $4.50 CSCL 03B

Numerical experiments are performed to examine the effects of line shape and band structure on the radiative equilibrium temperature profile in planetary atmospheres. In order to accurately determine these effects, a method for calculating radiative terms is developed which avoids the usual approximations. It differs from the more commonly used methods in that it allows arbitrary dependence of the absorption coefficient on wave number, without requiring tedious line by line integration and without the constraints of band models. The present formulation is restricted to homogeneous atmospheres but the concept can be extended to the more general case. The numerical experiments reveal that the line shape and band structure of the absorbing gases have a large effect on temperatures in the higher layers of the atmosphere (corresponding to the stratosphere and mesosphere). The more nongrey the spectrum (that is, the higher the peaks and the deeper the troughs in the spectrum), the lower the temperature. Author

N72-25828*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA ACQUISITION AND PROCESSING HISTORY FOR THE EXPLORER 33 (AIMP-D) SATELLITE
Thomas J. Karras Apr. 1972 32 p
(NASA-TM-X-65894; X-564-72-141) Avail: NTIS HC $3.75 CSCL 22A

The quality control monitoring system, using accounting and quality control data bases, made it possible to perform an in-depth analysis. Results show that the percentage of useable data files for experimenter analysis was 97.7%; only 0.4% of the data sequences supplied to the experimenter exhibited missing data. The 50 percentile probability delay values (referenced to station record data) indicate that the analog tapes arrived within 11 days, the data were digitized within 4.2 weeks, and the experimenter tapes were delivered in 8.95 weeks or less.
Author

N72-25829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRIC FIELDS IN THE MAGNETOSPHERE
J. P. Heppner May 1972 20 p refs Submitted for publication
(NASA-TM-X-65895; X-645-72-154) Avail: NTIS HC $3.00 CSCL 03B

Two techniques, tracking the motions of Ba(+) clouds and measuring the differences in floating potential between symmetric double probes, were successful in: (1) demonstrating the basic convective nature of magnetospheric electric fields, (2) mapping global patterns of convection at upper ionosphere levels, and (3) revealing the physics of electric currents in the ionosphere and the importance of magnetosphere-ionosphere feedback in altering the imposed convection. Author

N72-25830*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHORT ARC OPTICAL SURVEY TECHNIQUES
John H. Berbert and Fred M. Loveless (DBA Systems, Inc.) Dec. 1971 56 p refs
(Contract NAS5-10618)
(NASA-TM-X-65896; X-550-71-496) Avail: NTIS HC $5.00 CSCL 08G

The effect of the gravity parameter, mu, the choice and local survey of the fixed origin station, and the choice of initial datum on the results of short arc satellite survey adjustments were investigated using GEOS 1 MOTS optical observations from 13 stations. It is concluded that each of these parameters has an effect on derived network scale on the order of 0.000002 for the nominal variations used. A particular solution using assumed best available values for these parameters is recommended. Author

N72-25831*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF THE CORIOLIS FORCE ON THE STABILITY OF ROTATING MAGNETIC STARS
Kunitomo Sakurai Mar. 1972 7 p
(NASA-TM-X-65899; X-693-72-71) Avail: NTIS HC $3.00 CSCL 03A

The effect of the Coriolis force on the stability of rotating magnetic stars in hydrostatic equilibrium is investigated by using the method of the energy principle. It is shown that this effect is to inhibit the onset of instability. Author

N72-25832*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRECIPITATION OF LOW ENERGY ELECTRONS AT HIGH LATITUDES: EFFECTS OF SUBSTORMS, INTERPLANETARY MAGNETIC FIELD AND DIPOLE TILT ANGLE
J. L. Burch May 1972 12 p refs Submitted for publication
(NASA-TM-X-65902; X-646-72-151) Avail: NTIS HC $3.00 CSCL 03B

Data from the auroral particles experiment on OGO-4 were used to study effects of substorm activity, interplanetary magnetic field latitutde, and dipole tilt angle on high-latitude precipitation of 700 eV electrons. It was found that: (1) The high-latitude zone of 700 eV electron precipitation in late evening and early morning hours moves equatorward by 5 to 10 deg during substorms. (2) The low-latitude boundary of polar cusp electron precipitation at 9 to 15 hours MLT also moves equatorward by several degrees during substorms and, in the absence of significant substorm activity, after a period of southward interplanetary magnetic field. (3) With times containing substorm activity or a southward interplanetary magnetic field eliminated, the low-latitude boundary of polar cusp electron precipitation is found to move by approximately 4 deg over the total yearly range of tilt angles. At maximum winter and summer conditions the invariant latitude of the boundary is shown to shift by approximately -3 deg and +1 deg respectively from its equinox location. Author

N72-25833# Bern Univ. (Switzerland).
TRAPPED SOLAR WIND NOBLE GASES IN APOLLO 12 LUNAR FINES 12001 AND APOLLO 11 BRECCIA 10046
P. Eberhardt, J. Geiss, H. Graf, N. Groegler, M. D. Mendia, M. Moergeli, H. Schwaller, A. Stettler, U. Kraehenbuehl, and H. R. vonGunten Feb. 1972 91 p refs Submitted for publication
Avail: NTIS HC $6.75

The concentrations and isotopic composition of the five noble gases were measured in an unseparated bulk sample of the Apollo 12 fines 12001, in seven bulk and five ilmenite grain size fractions from 12001, and in four ilmenite grain size fractions separated from the Apollo 11 breccia 10046. In addition, Sr, Zr, Ba, La, Ce, Sm, and Eu were determined in several bulk grain size fractions from 12001. Data and detailed discussions are presented on the following measurements: anticorrelation between the concentration of trapped solar wind noble gases and grain size; ratios of individual isotopes of trapped solar wind gases in bulk, ilmenite grain size fractions, and ilmenites; isotopic composition of surface correlated trapped Ne isotopes; ratio of surface correlated trapped Ar isotopes; isotopic composition of surface correlated Kr; and isotope ratios of surface correlated Xe. The exposure ages for the 12001 soil

are between 300 million yr (ilmenite) and 440 million yr (bulk grain size fractions). The ilmenite of breccia 10046 has an exposure age of 800 million yr. Author

N72-25834# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 277
1 Jun. 1972 73 p refs Transl. into ENGLISH from various Sino-Soviet bloc publications
(JPRS-56154) Avail: NTIS HC $5.75

Translations and abstracts of articles are presented on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-25835# Committee on Science and Astronautics (U. S. House).
APOLLO 16 MISSION REPORT "Something Worthwhile for Our Fellow Man," Captain John Young
Washington GPO 1972 30 p Hearing before Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., no. 18, 16 May 1972
Avail: Comm. on Sci. and Astronaut.

A report is presented to the House Committee on the Apollo 16 flight by the astronauts and is illustrated by photographs taken by them. Preliminary results and the type of results expected from detailed examinations are outlined. The EVAs in the Cayley Plains and Descrate crater regions are described; the samplings and scientific experiments and experience of the lunar rover in motion are included. Photographs of the earth showing the intensity of the ultraviolet light around it are discussed, along with photographs of the moon taken in orbit. N.E.N.

N72-25836*# Northrop Services, Inc., Huntsville, Ala.
SHUTTLE ON-ORBIT RENDEZVOUS TARGETING: CIRCULAR ORBITS
Earle L. Bentley May 1972 120 p
(Contract NAS8-21810)
(NASA-CR-123713; M-244-1082) Avail: NTIS HC $8.00 CSCL 22A

The strategy and logic used in a space shuttle on-orbit rendezvous targeting program are described. The program generates ascent targeting conditions for boost to insertion into an intermediate parking orbit, and generates on-orbit targeting and timeline bases for each maneuver to effect rendezvous with a space station. Time of launch is determined so as to eliminate any plane change, and all work was performed for a near-circular space station orbit. Author

N72-25837# Institut d'Aeronomie Spatiale de Belgique, Brussels.
DETERMINATION OF THE VERTICAL DISTRIBUTION OF STRATOSPHERIC METHANE BY BALLOON BORNE INFRARED SPECTROMETRY [DETERMINATION DE LA DISTRIBUTION VERTICALE DU METHANE STRATOSPHERIQUE PAR SPECTROMETRIE INFRAROUGE EN BALLON]
M. Ackerman, D. Frimout, C. Lippens, and C. Muller 1972 17 p refs In FRENCH; ENGLISH summary Submitted for publication
(Aeronomica-Acta-A-97-1972) Avail: NTIS HC $3.00

Solar spectra recorded by a balloon-borne spectrometer over 3 to 4 micron wavelength range at solar zenith angles between 75 and 95 deg from an altitude of 34 km are presented. The mixing ratio of methane between 16 and 33 km which is deduced from the measurements decreases in the stratosphere. These observational results show that the mixing ratio decreases by a factor of about 3 between the tropopause at 13.5 km and at the altitude of 33 km in the stratosphere.
Author (ESRO)

N72-25838# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS OF THE ORBIT COSMOS 268 ROCKET (1969-20B)
D. G. King-Hele and A. N. Winterbottom Sep. 1971 23 p refs
(RAE-TR-71202; BR27242) Avail: NTIS HC $3.25

The orbit of Cosmos 268 rocket was determined at 28 epochs during its 342 day life, with the aid of the PROP5 orbit refinement program. All available observations were used, including 16 from the Hewitt camera at Malvern, 28 from the 200 mm camera at Meudon, 56 from the kinetheodolite at the Cape Observatory, 700 visual observations from volunteer observers, 500 US Navy observations, and 200 British radar observations. The orbits are of very good accuracy for a high drag satellite, most of the values of inclination having standard deviations less than 0.002 deg. The most accurate orbits are those utilizing photographic observations, and the best of these has standard deviations of 0.00001 in eccentricity and 0.0001 deg in inclination. The values of inclination obtained, after correction to allow for the effects of other perturbing forces, were analyzed to determine zonal wind speeds in the upper atmosphere at heights a little above perigee (230-250 km) averaged over latitudes up to about 25 deg. Author (ESRO)

N72-25839# Osservatorio Astrofisico di Arcetri, Florence (Italy).
DETECTION METHOD OF (H 21 CM) AND OTHER LINES IN THE RADIO SPECTRUM OF THE SUN Final Scientific Report, 1 Jan. 1967 - 30 Jun. 1969
Giancarlo G. Noci, Alberto M. Cantu, Franca G. ChiuderiDrago, and Laura A. GrifoniMantellini 1 Dec. 1971 68 p refs
(Contract F61052-67-C-0042; AF Proj. 5629)
(AD-737850; AFCRL-72-0103) Avail: NTIS CSCL 03/2

The intensity was investigated of the hydrogen 3 cm and 21 cm lines in the solar spectrum. A form of the transfer equation, suitable for the high precision required, was found together with a technique for avoiding, in its integration, the singularity at the turning point. The method followed to calculate the populations is described and the transition rate coefficients are discussed. A model of the atmosphere is presented and the populations of the levels $n = 3$, $n = 4$ of the hydrogen atom are found, as functions of the height above the photosphere. The population equilibrium of the most important states in the chromosphere, in the transition region and in the corona is discussed. The intensity of the 3 cm line is calculated: it turns out to be too small to be detected. An analogous procedure, relative to the 21 cm line, is followed for a cold quiet prominence. Author (GRA)

N72-25840# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION ENGINEERING] Quarterly Progress Report
15 Jan. 1972 375 p refs
(Contract DAAB07-71-C-0300)
(AD-737814; QPR-104) Avail: NTIS CSCL 05/2

The document contains progress reports of research on topics such as molecular beams, microwave spectroscopy, atomic resonance and scattering, radio astronomy, solid-state microwave electronics, cooperative phenomena in solids and fluids, gravitation research, magnetic resonance, physical electronics and surface physics, physical acoustics, electrodynamics of media, laser applications, plasmas and controlled nuclear fusion, gaseous electronics, relativistic beams, detection and estimation theory, speech communication, linguistics, cognitive information processing, communications biophysics, neurophysiology, and signal processing. GRA

N72-25141# Joint Publications Research Service, Arlington, Va.
ON THE CHOICE OF AN INDEX FUNCTION FOR LONG-TERM PROGNOSTICATION OF THE DEVELOPMENT OF SCIENCE
P. B. Vasylyk *In its* Cybernetics Res. Reported 23 May 1972

p 53-64 refs (See N72-25135 16-05)
Avail: NTIS HC $5.75

N72-25239# European Space Operations Center, Darmstadt (West Germany).
SPACE DATA SERVICE
K. G. Lenhart *In* ESRO Spacecraft Operations, vol. 6 Mar. 1972 p 50-57 refs (See N72-25233 16-08)
Avail: NTIS HC $6.50

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-25841 Kansas Univ., Lawrence.
DESIGN OF A REPRESENTATIVE LIQUID FUEL LAUNCH VEHICLE MODEL TO DEMONSTRATE THE POGO PHENOMENON Ph.D. Thesis
Bill Grant Tompkins 1971 275 p
Avail: Univ. Microfilms Order No. 71-27234

Several tests were conducted to determine the resonant characteristics of the model vehicle's structural and propellant systems. Other tests simulating actual flight conditions were conducted to determine the frequency of maximum structural and fluid gain. This data was also used to develop model system transfer functions. The point of maximum structural and fluid gain occurred at the intersection of the first structural resonance curve and the second fluid resonance curve. Linearity testing indicated no significant shift of the gain curves due to variation of excitation input amplitude. Results of fluid system testing indicated that cavitation had very little effect on the point of maximum gain. Transfer functions were developed using digital computation methods. Plots of these transfer functions compared favorably with actual experimental data. A method is described that allows the investigator to closely simulate actual vehicle in-flight conditions and study the actual pogo-like phenomenon without fear of damage to the vehicle under test. Dissert Abstr.

N72-25842* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SCIENTIFIC EXPERIMENT FLEXIBLE MOUNT Patent
Horace E. Whitacre and Arthur R. White, inventors (to NASA) Issued 16 May 1972 9 p Filed 17 Aug. 1970 Supersedes N70-41959 (08 - 24, p 4607)
(NASA-Case-MSC-12372-1; US-Patent-3,662,661; US-Patent-Appl-SN-64391; US-Patent-Class-95-12.5) Avail: US Patent Office CSCL 22B

An apparatus is described for mounting scientific experiments in a spacecraft which permits their utilization without maneuvering of the spacecraft. One end of an elongated flexible bellows is hermetically attached to the framework of the spacecraft in an encircling relationship about an opening. The other end is sealed over with an adapter plate to permit interconnection of a camera, optical system, sextant, or other equipment. A gimbal system attaches the adaptor plate to the frame of the spacecraft permitting rotational movement on a pair of orthogonal axes. Drive motors or hand operated adjusting means interconnect the pair of gimbals for controlled movement of the scientific experiment.
Official Gazette of the U.S. Patent Office

N72-25843*# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
STUDY OF AERODYNAMIC SURFACE CONTROL OF SPACE SHUTTLE BOOST AND REENTRY, VOLUME 1 Final Report, Apr. 1971 - Mar. 1972
C. J. Chang, C. L. Connor, and G. P. Gill Mar. 1972 137 p refs
(Contract NAS8-26772)
(NASA-CR-123644; HREC-6772-1-Vol-1; LMSC-HREC-D225700-1) Avail: NTIS HC $9.00 CSCL 22C

The optimization technique is described which was used in the study for applying modern optimal control technology to the design of shuttle booster engine reaction control systems and aerodynamic control systems. Complete formulations are presented for both the ascent and reentry portions of the study. These formulations include derivations of the 6D perturbation equations of motion and the process followed in the control and blending law selections. A total hybrid software concept applied to the study is described in detail. Conclusions and recommendations based on the results of the study are included. D.L.G.

N72-25844*# Lockheed Missiles and Space Co., Huntsville, Ala. Huntsville Research and Engineering Center.
STUDY OF AERODYNAMIC SURFACE CONTROL OF SPACE SHUTTLE BOOST AND REENTRY, VOLUME 2 Final Report, Apr. 1971 - Mar. 1972
C. J. Chang, C. L. Connor, and G. P. Gill Mar. 1972 118 p
(Contract NAS8-26772)
(NASA-CR-123645; HREC-6772-2-Vol-2; LMSC-HREC-D225700-2-Vol 2) Avail: NTIS HC $8.00 CSCL 22C

The derivations of mathematical models in Vol. 1 are presented along with descriptions of all peripheral studies related to the primary study objectives. D.L.G

N72-25845*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF ADVANCED TECHNIQUES FOR DETERMINING THE LONG-TERM PERFORMANCE OF COMPONENTS Interim Report
Mar. 1972 223 p refs Prepared for JPL
(Contract NAS7-782)
(NASA-CR-126720; TRW-16568-6014-R000) Avail: NTIS HC $13.25 CSCL 22B

A study was conducted of techniques having the capability of determining the performance and reliability of components for spacecraft liquid propulsion applications for long term missions. The study utilized two major approaches; improvement in the existing technology, and the evolution of new technology. The criteria established and methods evolved are applicable to valve components. Primary emphasis was placed on the propellants oxygen difluoride and diborane combination. The investigation included analysis, fabrication, and tests of experimental equipment to provide data and performance criteria. D.L.G.

N72-25846*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 11 MISSION REPORT, SUPPLEMENT 5: PERFORMANCE OF LUNAR MODULE REACTION CONTROL SYSTEMS
Donald R. Blevins and Lonnie W. Jenkins Dec. 1971 42 p
(NASA-TM-X-68342; MSC-PA-R-69-2; MSC-00171; Suppl-5) Avail: NTIS HC $4.25 CSCL 22C

Spacecraft velocity data and crew reports indicated that RCS engine performance was nominal. It is estimated that the RCS engines accumulated a total of 1060 seconds on-time and 12,000 firings during the mission. The quad temperatures ranged from 132 to 232 F during the period when the heaters were active, within predicated ranges. The total propellant consumption from the RCS tanks was about 319 pounds, compared to a predicted value of 253 pounds. An additional 69 pounds of propellant were used from the ascent propulsion system tanks during interconnect feed operations associated with APS lift-off, following periods of rapid propellant usage. The only problems noted were two thrust chamber pressure switch failures on the quad one down-firing engine and on the quad 2 aft-firing engine. Engine performance was nominal on both engines, and the switch failures had no effect on the mission. Author

N72-25847# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
SYNTHESIS OF STUDIES ON THE SATELLITE STABILIZATION BY ION THRUSTERS
J. Lagasse, A. Costes, and J. C. Laprie [1972] 10 p refs
(Publ-893) Avail: NTIS HC $3.00

The analysis and design of systems of telecommunication satellite stabilization by ion propulsion are presented. Three points were emphasized: (1) determination of different static transfer function of the cesium contact ion type of microthruster; (2) statement of orginal laws of attitude control; and (3) identification of the mathematical models. Also given are the definition of the principle characteristics of stabilization systems by ion propulsion, design and realization of the electronics associated with the microthruster, and the technical and economical problems associated with the study. Author

N72-25848*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 15 MISSION MAIN PARACHUTE FAILURE Anomaly Report no. 1
Dec. 1971 32 p
(NASA-TM-X-68350; MSC-05805) Avail: NTIS HC $3.75 CSCL 22C

The failure of one of the three main parachutes of the Apollo 15 spacecraft was investigated by studying malfunctions in the forward heat shield, broken riser, and firing the fuel expelled from the command module reaction control system. It is concluded that the most probable cause was the burning of raw fuel being expelled during the latter portion of depletion firing. Recommended corrective actions are included. F.O.S.

N72-25849# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
CONTROL METHODS FOR 5 INCH HIGH-VELOCITY AIRCRAFT ROCKETS (HVAR) [CONTROLE BRUIKBAARHEID VAN 5 INCH HIGH VELOCITY AIRCRAGT ROCKETS (HVAR)]
28 Jun. 1971 25 p refs In DUTCH
(TL-1971-7; TDCK-58256) Avail: NTIS HC $3.25

Nondestructive and destructive quality control tests on aircraft rockets and their ignition characteristics are reported. Statistical analysis of obtained results shows that rockets perform according to standards and that the chemical composition of the black gunpowder is amply explosive.
Transl. by G.G.

N72-25850*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 16/AS-511/LM-11 OPERATIONAL CALIBRATION CURVES. VOLUME 1: CALIBRATION CURVES FOR COMMAND SERVICE MODULE CSM 113
J. F. DeMoss, comp. Dec. 1971 1071 p
(NASA-TM-X-68322) Avail: NTIS HC $55.55 CSCL 22B

Calibration curves for the Apollo 16 command service module pulse code modulation downlink and onboard display are presented. Subjects discussed are: (1) measurement calibration curve format, (2) measurement identification, (3) multi-mode calibration data summary, (4) pulse code modulation bilevel events listing, and (5) calibration curves for instrumentation downlink and meter link. Author

N72-25851*# National Aeronautics and Space Administration, Washington, D.C.
PRELIMINARY CRITERIA FOR THE FRACTURE CONTROL OF SPACE SHUTTLE STRUCTURES Space Vehicle Design Criteria (Structures)
Jun. 1971 16 p refs
(NASA-SP-8095) Avail: NTIS HC $3.00 CSCL 22B

The complex and multidisciplinary factors are presented which relate to the prevention of structural failure due to the initiation or propagation of cracks or crack-like defects. The fracture control criteria are applicable to space shuttle components which are: (1) susceptible to cracking or fracture on the basis of anticipated loads and environment, and (2) critical to either crew safety or system performance. The criteria define the design, fabrication, environmental control, inspection, maintenance, repair, and verification procedures required for adequate fracture control. D.L.G.

N72-25852*# Uniroyal, Inc., Mishawaka, Ind.
DEVELOPMENT OF A COLLAPSIBLE REINFORCED CYLINDRICAL SPACE OBSERVATION WINDOW
Abdul Q. Khan 31 Dec. 1971 171 p refs
(Contract NAS1-10076)
(NASA-CR-112085) Avail: NTIS HC $10.75 CSCL 22B

Existing material technology was applied to the development of a collapsible transparent window suitable for manned spacecraft structures. The effort reported encompasses the evaluation of flame retardants intended for use in the window matrix polymer, evaluation of reinforcement angle which would allow for a twisting pantographing motion as the cylindrical window is mechanically collapsed upon itself, and evaluation of several reinforcement embedment methods. A fabrication technique was developed to produce a reinforced cylindrical space window of 45.7 cm diameter and 61.0 cm length. The basic technique involved the application of a clear film on a male-section mold; winding axial and girth reinforcements and vacuum casting the outer layer. The high-strength transparent window composite consisted of a polyether urethane matrix reinforced with an orthogonal pattern of black-coated carbon steel wire cable. A thin film of RTV silicone rubber was applied to both surfaces of the urethane. The flexibility, retraction system, and installation system are described. Author

N72-25853*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIPLE IN-LINE DOCKING CAPABILITY FOR ROTATING SPACE STATIONS Patent Application
Leon B. Weaver and Claude D. Pegden, inventors (to NASA) Filed 12 Apr. 1972 18 p
(NASA-Case-MFS-20855-1; US-Patent-Appl-SN-243374) Avail: NTIS HC $3.00 CSCL 22B

The means for hard docking a number of space vehicles with a rotating space station includes an axially positioned dome on which are located two intermeshing docking turrets. Each turret carries multiple docking ports extending radially from the turret axis, along which final access to the space station is accomplished through the turret hub. The turrets intermesh and rotate about their hubs, by means of a power source and suitable ring gears and bevel pinions, to successively position one of the docking ports on the axis of rotation of the space station, while the remaining ports are positioned off center, and alternately rotated into such docking position to receive an additional spacecraft. The arrangement allows docking in-line with the axis of rotation of the station, and multiple vehicles to be thus docked and then placed in holding position. NASA

N72-25854*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NATURAL ENVIRONMENT DESIGN REQUIREMENTS FOR THE SORTIE MODULE
George S. West, Jr. 2 Jun. 1972 10 p refs
(NASA-TM-X-64668) Avail: NTIS HC $3.00 CSCL 22B

Since this module is carried as cargo to orbital altitudes in the space shuttle bay, orbital environmental impacts are emphasized. Author

N72-25855*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: MISSION PLANNING FOR LUNAR MODULE DESCENT AND ASCENT
Floyd V. Bennett Washington Jun. 1972 48 p refs
(NASA-TN-D-6846; MSC-S-295) Avail: NTIS HC $3.00 CSCL

22B

The premission planning, the real-time situation, and the postflight analysis for the Apollo 11 lunar descent and ascent are described. A comparison between premission planning and actual results is included. A navigation correction capability, developed from Apollo 11 postflight analysis was used successfully on Apollo 12 to provide the first pinpoint landing. An experience summary, which illustrates typical problems encountered by the mission planners, is also included. Author

N72-25856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: LUNAR MODULE INSTRUMENTATION SUBSYSTEM
David E. OBrien, III and Jared R. Woodfill, IV Washington Jun. 1972 58 p refs
(NASA-TN-D-6845; MSC-S-294) Avail: NTIS HC $3.00 CSCL 22B

The design concepts and philosophies of the lunar module instrumentation subsystem are discussed along with manufacturing and systems integration. The experience gained from the program is discussed, and recommendations are made for making the subsystem more compatible and flexible in system usage. Characteristics of lunar module caution and warning circuits are presented. Author

N72-25857*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: THE DOCKING SYSTEM
Robert D. Langley Washington Jun. 1972 51 p
(NASA-TN-D-6854; MSC-S-325) Avail: NTIS HC $3.00 CSCL 22B

The decision to accomplish the lunar landing mission by use of the lunar orbit rendezvous technique required that a docking system be developed to allow: (1) spacecraft modules to be structurally joined, (2) intravehicular transfer of the crew and equipment, and (3) separation of the modules. The basic design criteria of the docking system, the evolution process, and the various docking concepts considered for the Apollo program are presented. Docking systems that were considered for the Apollo program included both impact and nonimpact systems; a probe and drogue impact system was selected. Physical and functional descriptions of the probe and drogue, the crew transfer tunnel, and docking ring latches are presented for both the early configuration and the present configuration as influenced by the development and qualification test programs. In addition, preflight checkout activity and mission performance of the system are discussed. Author

N72-25858*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: SUPERSONIC AERODYNAMIC CHARACTERISTICS OF THE MSC 040A ORBITER (M EQUALS 2.0 TO 4.0)
F. Tessitore, M. Quan, R. Romere, R. Moore, and R. Weaver May 1972 314 p
(Contract NAS8-4016)
(NASA-CR-120033; DMS-DR-1221; NASA-Ser-S-0055) Avail: NTIS HC $17.75 CSCL 22B

A wind tunnel test of the space shuttle orbiter configuration 040A was run in a 20 in. supersonic wind tunnel. Basic aerodynamic data for this vehicle were determined at Mach 2.0, 2.4, 3.0 and 4.0. Author

N72-25859*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: DIRECTIONAL AND LATERAL STABILITY AND INTERFERENCE EFFECTS OF CRUISE ENGINE LOCATION ON A 0.015 SCALE SPACE SHUTTLE
R. Buchholz May 1972 741 p
(Contract NAS8-4016)
(NASA-CR-120019; DMS-DR-1192; NASA-Ser-S-1036) Avail: NTIS HC $39.25 CSCL 22B

The results are presented that were obtained from a wind tunnel tests to improve space shuttle booster baseline lateral-directional stability, control characteristics, and cruise engine location optimization. Tests were conducted in a 7 x 10-foot transonic wind tunnel. The model employed was a 0.015-scale replica of a space shuttle booster. The three major objectives of this test were to determine the following: (1) force, static stability, and control effectiveness characteristics for varying angles of positive and negative wing dihedral and various combinations of wing tip and centerline dorsal fins; (2) force and static stability characteristics of cruise engines location on the body below the high aerodynamic canard; and (3) control effectiveness for the low-mounted wing configuration. The wing dihedral study was conducted at a cruise Mach number of 0.40 and simulated altitude of 10,000 feet. Portions of the test were conducted to determine the control surfaces stability and control characteristics over the Mach number range of 0.4 to 1.2. The aerodynamic characteristics determined are based on a unit Reynolds number of approximately 2 million per foot. Boundary layer trip strips were employed to induce boundary layer transition. Author

N72-25860*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GSFC ORBIT COMPUTATIONS FOR ISAGEX OPERATIONS
R. W. Agreen, J. G. Marsh, J. P. Murphy, and M. L. Sandson (Computer Sci. Corp.) Jan. 1972 32 p refs
(NASA-TM-X-65886; X-553-72-23) Avail: NTIS HC $3.75 CSCL 22B

The objective of the program is to collect a set of homogeneous and well-distributed precise laser and camera satellite observations for the purpose of dynamic and geometric geodesy. The data gathering portion of the experiment extended from December 15, 1970 to August 31, 1971 and consisted of seven three-week saturation tracking periods. The seven geodetic satellites tracked were BE-B, BE-C, GEOS-1, GEOS-2, DI-C, DI-D, and PEOLE. The techniques employed to generate acquisition data for the two lasers are described. Analyses of the quick-look Astrosoviet NAFA-25 camera data indicated that the accuracy of these data was on the order of a few minutes of arc. These data were useful in definitive orbit determination. Author

N72-25861*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
UK-4 PROTOTYPE SPACECRAFT MAGNETIC TESTS
W. E. Pruett Apr. 1972 29 p refs
(NASA-TM-X-65890; X-325-72-128) Avail: NTIS HC $3.50 CSCL 22B

The spacecraft was tested in a magnetic test facility which uses a 42 ft. diameter coil system to produce a controlled magnetic field of high uniformity over a large central volume. The primary objectives of the tests were: (1) to determine the permanent, induced, and stray magnetic moments of the spacecraft and to assess its magnetic stability; (2) to evaluate the magnetorquer coil system; and (3) to deperm, compensate, and make other adjustments necessary to achieve satisfactory magnetic characteristics for the spacecraft. The test facility and procedures are described together with the results obtained. In addition, the problems encountered during the tests and the significance of the test findings are discussed. D.L.G.

N72-25862*# Martin Marietta Corp., Denver, Colo.
NEUTRAL BUOYANCY TESTING OF ARCHITECTURAL AND ENVIRONMENTAL CONCEPTS OF SPACE VEHICLE DESIGN Final Report
J. A. Lenda, A. A. Rosener, and M. L. Stephenson Mar. 1972 132 p
(Contract NAS9-11947)
(NASA-CR-115640; MSC-03773; DRL-T-628) Avail: NTIS HC $8.75 CSCL 22B

Design guidelines are presented that are applicable to providing habitability areas and furniture elements for extended periods in a zero gravity environment. This was accomplished by: (1) analyzing the existing habitability crew area requirements,

mobility and restraint aids, cross-cultural design, and establishing a man model for zero gravity; (2) designing specific furniture elements, chair and table, and volumes for a stateroom, office, bathroom, galley, and wardroom; and (3) neutral buoyancy testing and evaluation of these areas. Author

N72-25863*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: HEAT TRANSFER INVESTIGATION OF THE MCDONNELL-DOUGLAS DELTA WING ORBITER AT A NOMINAL MACH NUMBER OF 10.5
R. H. Eaves and T. D. Buchanan May 1972 126 p
(Contract NAS8-4016)
(NASA-CR-120024; DMS-DR-1206; NASA-Ser-H-1008) Avail: NTIS HC $8.50 CSCL 20M

Heat transfer tests for the delta wing orbiter were conducted in a hypervelocity wind tunnel. A 1.1 percent scale model was tested at a Mach number of approximately 10.5 over an angle of attack range from 10 to 60 degrees over a length Reynolds number range from 5 times 10 to the 6th power to 24 times 10 to the 6th power. Heat transfer results were obtained from model surface heat gage measurements and thermographic phosphor paint. Limited pressure measurements were obtained. Author

N72-25864*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 9 THERMAL-CONTROL-COATING DEGRADATION
James A. Smith Washington Jun. 1972 18 p refs
(NASA-TN-D-6863; MSC-S-314) Avail: NTIS HC $3.00 CSCL 22B

Analytical studies, ground-test data, and flight data before 1967 indicated that degradation of Apollo thermal-control coatings could be expected, possibly to an extent requiring spacecraft design changes to accomplish the worst-case lunar-landing mission. On the Apollo 9 mission, specimens of Apollo thermal-control coatings were retrieved by the astronauts during the extravehicular activity. These specimens were the first to be returned to earth from space unaffected by entry conditions. Subsequent measurements of the thermophysical properties (solar absorptance and hemispherical emittance) of the thermal-control-sample coatings revealed degradation levels well within the design capability of the Apollo spacecraft. Author

N72-25865*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ENTRY TRAJECTORY, ENTRY ENVIRONMENT, AND ANALYSIS OF SPACECRAFT MOTION FOR THE RAM C-3 FLIGHT EXPERIMENT
William L. Weaver and John T. Bowen Washington Jun. 1972 95 p refs
(NASA-TM-X-2562; L-8181) Avail: NTIS HC $3.00 CSCL 22C

The RAM C-3 flight experiment was launched to study the problem of radiofrequency blackout at an entry velocity of 24,300 ft/sec. The flight is described, and data for the entry trajectory and environment, which include the effects of actual temperature measured the day of launch, are presented. An analysis of entry spacecraft motions was performed. This analysis included the determination of wind angles from measured accelerations and estimates of wind angles at high altitudes from gyro-measured rotation rates. The maximum wind angles were found to be less than 5 deg to the point of pitch-roll resonance where the total wind angle increased to 8.5 deg and the roll rate started decreasing. A plausible cause for the decrease in roll rate was shown to be a combination of trim angle and an offset center of gravity. Author

N72-25866*# National Aeronautics and Space Administration, Washington, D.C.
ENVIRONMENTAL STATEMENT FOR PIONEER F/G PROGRAM
10 Jan. 1972 41 p refs
(NASA-TM-X-68340; PB-202085-F; ELR-1585) Avail: NTIS HC $4.25 CSCL 22C

The primary objective of the Pioneer F/G Program is to conduct exploratory investigations beyond the orbit of Mars of the interplanetary medium. Aspects of the Pioneer F and G launches which may affect environmental quality will be discussed in two areas: those related to the launch vehicle and those related to the spacecraft. There are insignificant adverse environmental effects from the products of the launch vehicle and from the radioisotope generators on the spacecraft. GRA

N72-25867*# Intermetrics, Inc., Cambridge, Mass.
INERTIAL SUBSYSTEM FUNCTIONAL AND DESIGN REQUIREMENTS FOR THE ORBITER (PHASE B EXTENSION BASELINE)
James H. Flanders and John P. Green, Jr. Feb. 1972 77 p
(Contract NAS9-11842)
(NASA-CR-115662) Avail: NTIS HC $6.00 CSCL 22B

The design requirements use the Phase B extension baseline system definition. This means that a GNC computer is specified for all command control functions instead of a central computer communicating with the ISS through a databus. Forced air cooling is used instead of cold plate cooling. Author

N72-25868# Joint Publications Research Service, Arlington, Va.
SPACECRAFT CONTROL SYSTEMS
31 May 1972 29 p refs Transl. into ENGLISH from "Upravleniye Kosmicheskimi Apparatami i Korablyami" Moscow, Sci. Publ. House, 1971 p 552-570
(JPRS-56134) Avail: NTIS HC $3.50

Methods are described for analyzing random effects in spacecraft control systems and for evaluating control system precision. For individual titles, see N72-25869 through N72-25870.

N72-25869# Joint Publications Research Service, Arlington, Va.
METHOD OF ANALYZING RANDOM PARAMETRIC EFFECTS IN SPACECRAFT CONTROL SYSTEMS
Ye. A. Fedosov and G. G. Sebryakov *In its* Spacecraft Control Systems 31 May 1972 p 2-14 refs (See N72-25868 16-31)
Avail: NTIS HC $3.50

The analytical method presented takes into account the random parametric perturbations manifested in the form of random scattering of the parameters of motion of the spacecraft in the presence of mobile masses. It is pointed out that a reactive moment develops in the spacecraft controls due to moving masses, leading ultimately to a random component of the instantaneous moment of inertia of the spacecraft, appearance of the damping effect of the moment of coriolis forces, and perturbation effect of the moment of forces of relative motion. The principles for analysis of stochastic linear and nonlinear systems in which there is a random scattering of nonlinear dependences are discussed, and mathematical expressions for the processes involved are developed. A parametric approximation method is utilized which consists in substitution of stochastic nonlinearity by a linear dependence with a random coefficient that takes into account the parametric action. D.L.G.

N72-25870# Joint Publications Research Service, Arlington, Va.
EVALUATING THE PRECISION OF SPACECRAFT CONTROL SYSTEMS
B. N. Petrov, A. Ya. Andriyenko, and Yu. P. Portnov-Sokolov *In its* Spacecraft Control Systems 31 May 1972 p 15-26 refs (See N72-25868 16-31)
Avail: NTIS HC $3.50

The disadvantages are discussed that result from use of the Monte Carlo method and equivalent perturbations methods in connection with the analysis of the statistical precision of control systems with a large number of perturbations. In order to overcome the deficiencies in these methods, alternative methods are proposed which relax the requirements on the equivalency of the perturbations, so that some of the conditions are satisfied

exactly, and some approximately. Three variations of methods, based on the premise, are presented. The first variation has a range of application to systems that can be calculated by the Monte Carlo method, but the proposed method obtains the desired accuracy without increasing the volume of calculations. The second variation is recommended for systems whose calculation by the Monte Carlo method is difficult because of the great amount of time required for calculating one execution of the control. The third variation is applicable to systems whose precision would be practically impossible to evaluate by the Monte Carlo method. D.L.G.

N72-25871*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THERMAL CONTROL SYSTEM FOR A SPACECRAFT MODULAR HOUSING Patent Application
Robert J. Eby (Fairchild Hiller Corp.) and Edward I. Powers, inventors (to NASA) Filed 17 Apr. 1972 16 p
(Contract NAS5-11609)
(NASA-Case-GSC-11018-1; US-Patent-Appl-SN-244523) Avail: NTIS HC $3.00 CSCL 20M

A thermal control system for a spacecraft module with some wall structure constructed of superinsulation and others of thermally conductive material is described. Thermal louvres and heat pipes provide a path of heat transfer from the interior of the module to space. A relatively uniform temperature is maintained throughout the module at all times with a relatively wide variation of the amount of heat dissipated by components within the module, and irrespective of variations in power usage or operating modes. NASA

N72-25872*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL DESIGN EQUATIONS, VOLUME 1
K. J. Cox 1 Dec. 1971 33 p refs Revised
(NASA-TM-X-68367; MSC-04217-Vol-1-Rev-B) Avail: NTIS HC $3.75 CSCL 22B

Revised documentation is presented pertaining to the computation requirements for guidance, navigation, and control of the space shuttle orbiter vehicle. Separate sections cover the following areas; (1) reference documents, (2) GN and C system description, (3) GN and C software functional requirements, and (4) coordinate systems and transformations. D.L.G.

N72-25873*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL DESIGN EQUATIONS. VOLUME 3: ORBITAL OPERATIONS
1 Dec. 1971 550 p Revised
(NASA-TM-X-68368; MSC-04217-Rev-B) Avail: NTIS HC $29.50 CSCL 22B

Revised specifications are presented of the equations necessary to perform the guidance, navigation, and control onboard computation functions for the space shuttle orbiter vehicle. The orbital operations covered include: (1) orbital coast, (2) orbital powered flight, (3) rendezvous mission phase, (4) station keeping mission phase, (5) docking and undocking, and (6) docked operations. D.L.G.

N72-25874*# Grumman Aerospace Corp., Bethpage, N.Y.
ALTERNATE SPACE SHUTTLE CONCEPTS STUDY. PART 2: TECHNICAL SUMMARY. VOLUME 2: ORBITER DEFINITION
6 Jul. 1971 431 p refs Prepared in cooperation with Boeing Co.
(Contract NAS9-11160)
(NASA-CR-115654; MSC-03810-B-1) Avail: NTIS HC $23.75 CSCL 22B

A study was conducted of a three-engined external hydrogen tank orbiter/heat sink booster utilizing 415 K sea level thrust engines. The results of the study, pertaining to the orbiter portion of the configuration, are presented. A complete summary of characteristics is given for the external tank configuration along with some comparative data for a conventional internal tank configuration. D.L.G.

N72-25875*# Systems Technology, Inc., Hawthorne, Calif.
APPLICATION OF AN APPROACH AND LANDING SYSTEM MODEL TO THE SPACE SHUTTLE ORBITER VEHICLE
Walter A. Johnson and Richard J. DiMarco Feb. 1972 82 p refs
(Contract NAS2-6275)
(NASA-CR-114465) Avail: NTIS HC $6.25 CSCL 22B

An analytic model and procedure are described which can be used to estimate probability distributions of touchdown conditions, without utilizing a Monte Carlo simulation. Example applications are presented, including one-step and two-step flare strategies for the space shuttle orbiter. The computed probability distributions for the two-step flare are compared with the corresponding histograms from an independent Monte Carlo simulation of the same situation. The computed distributions are very good fits to the Monte-Carlo-generated histograms for pertinent longitudinal and lateral variables at three points (including touchdown) along the vehicle's final approach trajectory. The model, thus verified, has more inherent power for assessing the effects of system element changes than conventional Monte Carlo techniques. Author

N72-25757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF SATELLITE THEORIES
H. G. Hertz *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 10-13 refs (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22A

N72-25758*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ANALYSIS OF THE EXPECTED ECCENTRICITY PERTURBATIONS FOR THE SECOND RADIO ASTRONOMY EXPLORER (RAE B)
James P. Murphy *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 14-17 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22A

N72-25759*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICAL IN-ORBIT BEHAVIOR OF THE RADIO ASTRONOMY EXPLORER SATELLITE
Harvey Walden *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 18-22 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22A

N72-25762*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-ORBIT FLEXIBLE SPACECRAFT DYNAMICS PROGRAM
Joseph V. Fedor *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 30-35 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 22C

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-25876 Oklahoma Univ., Norman.
COMPUTATION OF VIBRATION MODAL SHAPES AND NATURAL FREQUENCIES OF A GENERAL, ORTHOTROPIC-LAMINATED, THIN SHELL USING FINITE ELEMENTS Ph.D. Thesis
Gary Lee Thompson 1971 130 p
Avail: Univ. Microfilms Order No. 71-24997

Expressions for the stiffness and mass matrices were derived for a laminated anisotropic quadrilateral shallow shell element based on kinetic and strain energy principles. The difference in the total strain and kinetic energies of the system was minimized to form the characteristic eigenvalue-eigenvector expression for a dynamic system. Any of 32 possible nodal constraints can be imposed, and all eigenvalues and eigenvectors were determined for the resulting system. An aluminum curved panel with clamped and simply supported edge constraints, a 60 degree spherical cap with fixed hinge constraints, and a freely supported, boron epoxy circular cylinder were selected from the published literature to serve as sample check cases.
Dissert. Abstr.

N72-25877* Garrett Corp., Los Angeles, Calif.
LOW-CYCLE FATIGUE TESTING MACHINE Patent
Christos Demogenes and Connie E. Richard, inventors (to NASA) Issued 30 May 1972 5 p Filed 4 Aug. 1970 Supersedes N72-15874 (10 - 06, p 833) Sponsored by NASA
(NASA-Case-LAR-10270-1; US-Patent-3,665,751; US-Patent-Appl-SN-60881; US-Patent-Class-73-15.6; US-Patent-Class-73-100) Avail: US Patent Office CSCL 20K

A low-cycle, fatigue tester which simulates cyclic thermal loading by the application of cyclic mechanical stresses and deformations is described. The specimen is heated to the critical (most conducive to failure) temperature of the structure under consideration, and then deformed cyclically by the two interconnected, opposing, convex jaws of a mandrel driven reciprocally by an oscillating ram. The cyclic wrapping of the specimen around the opposing jaws of the mandrel mechanically induces alternating compression and tension stresses in the surface of the specimen which simulate the thermal stresses that would be caused by a temperature gradient through the depth of the structure under consideration. The stress level is controlled by the radius of the mandrel. The frequency of the oscillation is representative of the frequency of the thermal cycle affecting the structure.
Official Gazette of the U.S. Patent Office

N72-25878 Massachusetts Univ., Amherst.
FINITE DIFFERENCE METHODS FOR NONLINEAR DYNAMIC SHELL ANALYSIS Ph.D. Thesis
Mukti Lal Das 1971 152 p
Avail: Univ. Microfilms Order No. 71-25077

A systematic study is carried out to find the numerical stability criterion for explicit finite difference schemes used to solve linear dynamic plate and shell equations. Both classical and shear deformation type theories are studied. Comparisons between the predicted deflections for the two theories are made for nonlinear problems involving transverse dynamic loads. Range of validity of classical theory considered as a special case of the more general shear deformation theory is indicated. Numerical experiments conducted with nonlinear dynamic plate and shell equations show that the explicit finite difference scheme is feasible both for classical and shear deformation type theories with transverse loads. Practical experience shows about the same stability performance for the nonlinear problems as that predicted by the analysis of the linear dynamic equations.
Dissert. Abstr.

N72-25879 Colorado Univ., Denver.
FREE VIBRATION AND BUCKLING OF EDGE STIFFENED SQUARE PLATES Ph.D. Thesis
William Humes White 1971 139 p
Avail: Univ. Microfilms Order No. 71-25882

The free vibration of an edge-stiffened square plate was investigated by series solutions. The natural frequencies and mode shapes of an edge-stiffened square plate supported at the corners and subjected to in-plane normal stresses were analyzed by a modified Levy-type solution. The influence of the edge stiffeners on the fundamental frequency and first overtone is presented, as well as the influence on the static buckling stress. The natural frequencies and mode shapes of a completely free edge-stiffened square plate were analyzed by a Navier-type solution in conjunction with finite sine transforms. Graphs are presented to show the variation of the fundamental frequency due to the edge stiffeners.
Dissert. Abstr.

N72-25880 Waterloo Univ. (Ontario). Solid Mechanics Div.
BEHAVIOUR OF SAND DURING UNDRAINED TRIAXIAL TESTS
A. Thurairajah and B. LeLievre Sep. 1970 41 p refs
(Grant NRC A-2696)
(Rept-60) Avail: Issuing Activity

Undrained shear characteristics of saturated sand determined from triaxial compression and extension tests for a wide range of void ratio and consolidation pressure are presented. Results show that Mohr-Coulomb failure criterion underestimates strength of soil in stability problems.
Author

N72-25881 Waterloo Univ. (Ontario). Solid Mechanics Div.
THE LOADING-FREQUENCY RELATIONSHIP IN MULTIPLE EIGENVALUE PROBLEMS
K. Huseyin and J. Roorda Jun. 1970 23 p refs Sponsored by Natl. Res. Council of Can.
(Rept-43) Avail: Issuing Activity

The free vibrations of a linear conservative system with multiple loading parameters are studied, attention being restricted to pure eigenvalue problems. It is shown that the smallest frequency and external loading parameters of such a system constitute a strictly convex surface which cannot have convexity towards the origin of the parameter space. It is further proved that in the case of systems with one degree of freedom only, the surface takes the form of a plane. The practical implications of these results regarding the estimation of the frequencies and/or the stability boundary of the system are discussed.
Author

N72-25882 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON THE CALCULATION OF FLUTTER LOADS BY MEANS OF A VARIATIONAL TECHNIQUE
H. H. E. Leipholz Feb. 1972 35 p refs
(Grant NRC A-7297)
(Rept-105) Avail: Issuing Activity

Using an energy functional, including the potential energy of the nonconservative component of the external load where necessary, the differential equation, the boundary conditions, and the slope of the eigenvalue curve of the problems in question are obtained. The expression giving the slope of the eigenvalue curve is used to determine existence and magnitude of flutter loads.
Author

N72-25883 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON THE ANALYSIS SITUS OF EIGENVALUE CURVES OF RODS SUBJECTED TO CONSERVATIVE AND NON-CONSERVATIVE LOADS
H. H. E. Leipholz Feb. 1972 20 p refs
(Grant NRC A-7297)
(Rept-107) Avail: Issuing Activity

Using the Galerkin's first order approximations with the first and second modes of free vibrations as coordinate functions, the eigenvalue plane is divided into domains in which the eigenvalue curve can or cannot be located. To decide on the domains of location, certain parameters, P and Q, are defined and used. Taking, where necessary, the sign of slope and curvature of the eigenvalue curve into account, lower and upper bounds for the two first buckling loads are evaluated using the Galerkin's first order approximation.
Author

N72-25884 Waterloo Univ. (Ontario). Solid Mechanics Div.
FINITE ELEMENT ANALYSIS OF THE AXISYMMETRIC VIBRATIONS OF CYLINDERS
G. M. L. Gladwell and U. C. Tahbildar Feb. 1972 36 p refs Sponsored by Natl. Res. Council of Can.
(Rept-106) Avail: Issuing Activity

A finite element analysis is developed for finite and infinite solid or hollow cylinders in axisymmetric vibration. The elements themselves are solid or annular cylinders and have 16 degrees of freedom. Results are given for the propagation constants of solid and hollow infinite cylinders, and excellent agreement is found with those from the exact Pochhammer theory and Mindlin and McNiven's 3-mode theory. Frequency spectra are presented for the symmetric and antisymmetric modes of solid and hollow finite rods. Excellent agreement is found with experimental results, and this suggests that some of the results obtained from the 3-mode theory by McNiven et al, and in particular the frequency of the end mode, are in error by more than 10%. Author

N72-25885 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON THE SUFFICIENCY OF THE ENERGY CRITERION FOR THE STABILITY OF CERTAIN NON-CONSERVATIVE SYSTEMS OF THE FOLLOWER-LOAD TYPE
H. H. E. Leipholz Oct. 1970 21 p refs
(Grant NRC-A-7297)
(Rept-63) Avail: Issuing Activity

Using Galerkin's method it is shown that in the domain of divergence, the non-conservative system of the follower load type is always more stable than the corresponding conservative system. Since there are non-conservative systems of the divergence type, the critical load of the corresponding conservative system becomes a lower bound for the buckling load of such non-conservative systems. Hence, for such systems, the energy criterion remains sufficient for predicting stability. Moreover it is proven that even for more general non-conservative systems, the energy criterion is sufficient under certain restrictions. Author

N72-25886 Waterloo Univ. (Ontario). Solid Mechanics Div.
INVESTIGATION OF STABILITY OF CONTINUOUS NONCONSERVATIVE SYSTEMS WITH DAMPING BY MEANS OF LIAPUNOV'S METHOD
H. H. E. Leipholz and R. Kapoor Dec. 1970 27 p refs
(Grant NRC-A-7297)
(Rept-66) Avail: Issuing Activity

A Liapunov functional is obtained for continuous, non-conservative systems with damping. By requiring this functional to be positive definite and its time derivative to be negative definite, two stability conditions are obtained which determine the boundary of the stability domain. Since the conditions are only sufficient for stability, the domain obtained is certainly not always the possible largest domain. Author

N72-25887 Waterloo Univ. (Ontario). Solid Mechanics Div.
THE PLATES METHOD AND ITS APPLICATION IN THE SHELL THEORY
L. Fischer Dec. 1970 23 p refs
(Grant NRC D-10)
(Rept-67) Avail: Issuing Activity

The plate method as a general solution of flat shells in the bending state is presented. It is an iterative method with fast convergence, useful in problems of flat shells where other methods are not available or very complicated. The plate method converts the problems of shells into problems of plates and therefore is suitable for design applications. Applications to parabolic cylindrical shells (very long, long and short), hypars and conoid shells are presented. Author

N72-25888 Waterloo Univ. (Ontario). Solid Mechanics Div.
ON A MAXWELL-TYPE SOLUTION OF THREE-DIMENSIONAL ELASTICITY
H. H. E. Leipholz Mar. 1971 12 p refs
(Grant NRC-A-7297)
(Rept-79) Avail: Issuing Activity

Solutions of the boundary value problem of three dimensional elasticity are well known, if the problem is formulated in terms of displacements. If the problem is posed in terms of stresses, stress functions can be used, and Beltrami's equations can be replaced by corresponding equations for the stress functions. It is shown how a solution can be obtained for these partial differential equations if the stress functions of Maxwell are used. This solution in terms of stresses is then a counterpart to the solution of Papkovich-Neuber which is in terms of displacements. Author

N72-25889 Waterloo Univ. (Ontario). Solid Mechanics Div.
RANDOM BUCKLING BEHAVIOUR IN AXIALLY LOADED CYLINDRICAL SHELLS WITH AXISYMMETRIC IMPERFECTIONS
J. Roorda and J. S. Hansen May 1971 25 p refs Submitted for publication
(Rept-80) Avail: Issuing Activity

The imperfection sensitivity of axially compressed, long cylindrical shells with axisymmetric imperfections is analyzed from a statistical point of view. Koiter's deterministic results are used as a nonlinear transfer function between the imperfection distribution on the critical load distribution. The mean critical load and its standard deviation are obtained as functions of the mean, standard deviation and skewness of the imperfection distribution. The failure probability of a loaded shell is investigated for various imperfection statistics. Author

N72-25890 Waterloo Univ. (Ontario). Solid Mechanics Div.
STABILITY OF HAUGER AND PFLUGER SYSTEMS WITH KELVIN MODEL AND EXTERNAL DAMPING
H. H. E. Leipholz and Ravi Kapoor Jan. 1972 41 p refs Submitted for publication
(Grant NRC-A-7297)
(Rept-102) Avail: Issuing Activity

The complex influence of Kelvin mode and external damping on the quasi-stability domain of Hauger and Pfluger systems is investigated by the Galerkin's method and the results are compared with the values obtained by the method of Frobenius. It is shown for the Hauger system that for the internal damping at less than certain critical value, pseudodestabilization is possible. It is also shown that for the internal damping greater than another critical value, the external damping can lower the boundary of the asymptotic stability region. The significance of the optimal stability envelope in the critical load vs. internal damping plane is explained. Author

N72-25891 Waterloo Univ. (Ontario). Solid Mechanics Div.
YIELD SURFACES
Antoni Sawczuk (Polish Acad. of Sci., Warsaw) Mar. 1971 73 p refs Presented as series of lectures, Waterloo, Ont., 16-27 Nov. 1970
(TN-1) Avail: Issuing Activity

Yield surfaces for uniform shells are discussed in general terms. Specific forms for plates, cylindrical shells and long cylindrical panels are developed using Huber-Mises, Tresca, maximum reduced stress and maximum principal stress criteria. Yield surfaces for sandwich shells are considered in general and for cylindrical shells using Mises, Tresca, maximum reduced stress and maximum normal stress conditions. Methods for approximating yield criteria are considered and yield criteria for fiber reinforced panels are presented and applied to rotationally symmetric shells and isotropically reinforced plates. Yield criteria for anisotropic structures in terms of quadratic and piecewise linear yield conditions are studied and rib reinforced structures are considered. Author

N72-25892 Waterloo Univ. (Ontario). Solid Mechanics Div.
CYCLIC DEFORMATION AND FATIGUE BEHAVIOUR OF AXIAL AND FLEXURAL MEMBERS: A METHOD OF

SIMULATION AND CORRELATION
H. R. Jhansale and T. H. Topper Jun. 1971 35 p refs Presented at Intern. Conf. on Structural Mech. and Reactor Tech., Berlin, 20-24 Sep. 1971
(Grants NRC A-1694; DRB-9535-49)
(TN-4) Avail: Issuing Activity

Deformation models incorporating the various features of cyclic inelastic response such as memory of prior history, transient hardening or softening and cyclic relaxation or creep are essential in fatigue and shakedown analyses. Simple formulations of these features of cyclic response based on axial tests are combined into a digital computer model capable of simulating overall material response. The application of this model to evaluate fatigue damage is illustrated with a suitable fatigue damage criterion, a linear damage summation rule and a realistic cycle counting technique. Since the formulations governing cyclic stress-strain response are similar to those governing flexural response, the same model can be used to simulate the cyclic moment-curvature response, with a suitable modification of the parameters. A method of correlating deformation and fatigue behaviour under axial and flexural conditions based on the essential assumption that the cyclic stress-strain and fatigue properties derived from axial tests are applicable in flexural conditions, is presented. Some results of experimental studies supporting the above techniques of correlating and simulating deformation and fatigue response are also included. Although the complex nature of the problem has necessitated some simplifying approximations, the method is considered adequate for engineering analysis. Author

N72-25893 Waterloo Univ. (Ontario). Solid Mechanics Div.
OPTIMUM EDGE STIFFENERS FOR THIN-WALLED STRUCTURAL ELEMENTS
Kothapalli R. Venkataramaiah Jul. 1971 68 p refs Sponsored by Natl. Res. Council of Can.
(TN-7) Avail: Issuing Activity

An experimental investigation is presented which is aimed at obtaining optimum shape and optimum size edge stiffeners for thin-walled compression elements. The optimum edge stiffeners maximize the ultimate strength of plate composites and are compared with stiffeners recommended by the AISI specification. Author

N72-25894 Waterloo Univ. (Ontario). Solid Mechanics Div.
MULTI-PARAMETER OPTIMAL DESIGN OF PLATES AND SHELLS
Z. Mroz Mar. 1972 28 p refs
(Rept-109) Avail: Issuing Activity Submitted for publication Sponsored by Natl. Res. Council of Can.

For global behavioral constraints, the problem of optimal design of plates and shells is formulated by assuming the design to be dependent on a set of design parameters. Global minimum theorems are proved for some constraints, whereas for others only local extremum conditions are derived. The possibility of constructing numerical algorithms by using the optimality condition and proper variational principle is discussed. The following behavioral constraints are considered: (1) the prescribed mean compliance measured as the work of surface tractions, (2) the prescribed local deflection of linearly or nonlinearly elastic structure, (3) a given set of several free frequencies, (4) the prescribed safety factor for limit load of a plastic structure, and (5) any global constraint expressed as a surface integral with integrand depending on generalized stresses or strains. Author

N72-25895 Waterloo Univ. (Ontario). Solid Mechanics Div.
INFLUENCE OF KELVIN MODEL DAMPING IN FLUTTER-DIVERGENCE TRANSITIONAL POLYGENIC SYSTEMS
H. H. E. Leipholz and Ravi Kapoor Mar. 1972 78 p refs
(Grant NRC-A-7297)
(Rept-110) Avail: Issuing Activity

Elastomechanical systems were studied using a mathematical model of Kelvin-Voigt viscoelastic material. The influence of internal damping on the instability boundary parameters (critical load and flutter frequency) were observed for various values of load distribution exponent and ratio of monogenic polygenic loads. As these nonself-adjoint boundary eigenvalue problems involve system equations for which closed form solutions do not exist, the Galerkin method was applied and results were sample-checked by the independent Frobenius method. Author

N72-25896 Waterloo Univ. (Ontario). Solid Mechanics Div.
ELASTIC-PLASTIC DEFORMATION ANALYSIS USING LINEAR PROGRAMMING
Donald E. Grierson Jul. 1971 35 p refs Presented at 3d Can. Congr. of Appl. Mech., Calgary, Alberta, 17-21 May 1971 Submitted for publication Sponsored in part by Natl. Res. Council of Can.
(Rept-88) Avail: Issuing Activity

The elastic-plastic deformation analysis of plane frames is shown to be a quadratic programming problem and that the analysis may be reduced to a linear programming (LP) problem requiring, at most, two LP applications for solution. The formulation is based on a fully-pinned primary structure and is similar to the kinematic formulation of the collapse-load analysis as an LP problem. Adopting the LP formulation for both strength and deformation analyses, four examples are presented to illustrate the features of the approach, and the following were found: 1) the collapse load factor, 2) the collapse mechanism, 3) the bending moments at collapse, and 4) the inelastic rotations of plastic hinge sections at incipient structure collapse. Author

N72-25897 Waterloo Univ. (Ontario). Solid Mechanics Div.
THE ANALYSIS AND SYNTHESIS OF RESONATORS
G. M. L. Gladwell Feb. 1972 45 p refs
(Rept-16) Avail: Issuing Activity

A description is given of the four computer programs used in the design of longitudinally vibrating resonators made up of a number of linearly tapered sections. The first two programs find the natural frequencies and the end reactance of such a bar, while the second two design a bar with specified natural frequencies or reactance. The data input and ouput for the programs, and an example of each input are given along with instructions for preparing the data for other cases. The printouts of the programs are given in an appendix. Author

N72-25898# Technological Lab., RVO-TNO, Rijswijk (Netherlands).
PRELIMINARY INVESTIGATION OF THE VIBRATION OF THE WALLS OF THE TEST CELL FOR J-79-11A TURBOJET ENGINE TYPES [VOORONDERZOEK VAN DE TRILLINGEN VAN DE MUREN VAN DE TESTCEL VOOR STRAALMOTOREN VAN HET TYPE J-79-11A BIJ GSMW OP DE VLIEGBASIS WOENSDRECHT]
6 Aug. 1971 8 p In DUTCH
(TL-1971-11; TDCK-58326) Avail: NTIS HC $3.00

Measurements of vibration velocities, accelerations, and frequencies on inside and outside walls of a three dimensional place are reported. Results show that the possibility of crack formation exists and should be further explored. Transl. by G.G.

N72-25899# Aeronautical Research Labs., Melbourne (Australia).
THE FATIGUE LIFE OF SAFE LIFE AND FAIL-SAFE STRUCTURES: A STATE-OF-THE-ART REVIEW
F. H. Hooke Jun. 1971 62 p refs
(ARL/SM-Rept-334) Avail: NTIS HC $5.25

A review is made of the theory and practice for assessment of safe life and fail-safe structures, and of determinations of safe inspection intervals for fail-safe structures. The problem is one involving statistical variability and estimates are made of the intrinsic uncertainty in defining, for example, scatter factors, safe lives, or probabilities of failure. The greatest uncertainties arise from the inference of population mean, variance and distribution shape parameters from tests on small samples or samples not properly representative of the geometry or the actual service load history. Consideration is given to defining the optimum test load history to represent service conditions. Author

N72-25900# National Aeronautical Establishment, Ottawa (Ontario). Structures and Materials Section.
CURSHL: A HIGH-PRECISION FINITE ELEMENT FOR SHELLS OF ARBITRARY SHAPE
G. R. Cowper Dec. 1971 52 p refs
(NRC-12624; LR-560) Avail: NTIS HC $4.75

A high precision finite element is described for the linear static stress analysis of thin elastic shells of quite general shape. The element is a fully conforming displacement element of curvilinear triangular form. The theoretical basis of the element is presented, and some aspects of the organization of the computer program are discussed. The performance of CURSHL is examined with regard to accuracy of numerical integration, computation time, and representation of rigid body modes. Author

N72-25901# Technische Hogeschool, Delft (Netherlands). Laboratorium voor Energievoorziening en Kernreactoren.
SOME APPLICATIONS OF ENGINEERING MECHANICS IN PRESSURE VESSEL ANALYSIS
Dick Hans vanCampen Feb. 1972 151 p refs
(WTHD-35) Avail: NTIS HC $9.75

Pressure vessel characteristics, such as shape, overall dimensions, and service loads, are analyzed, along with the mechanical design. The two main limitations of traditional design codes are discussed. A finite element analysis of solids of revolution under nonaxisymmetric loads is presented. A large diameter, high pressure vessel flanges and nozzle-to-cylinder connections for small diameter ratios are also examined. J.A.M.

N72-25902*# Syracuse Univ., N.Y.
THEORETICAL STUDY OF CORRUGATED PLATES: SHEARING OF A CORRUGATED PLATE WITH CURVILINEAR CORRUGATIONS
Lung-Hsiang Wu and Charles Libove Washington NASA Jun. 1972 80 p refs
(Grant NGR-33-022-115)
(NASA-CR-2080; MAE-1833-T4) Avail: NTIS HC $3.00 CSCL 20K

A theoretical elastic analysis is presented for the in-plane shear of a corrugated plate with curvilinear corrugations and with discrete attachments between the ends of the corrugations and the surrounding members. The purpose of the analysis is to obtain information about the effective shear stiffness of the plate and the flexural strains that develop in it during the shearing process as a result of the attendant cross-sectional deformations. The crests and troughs of the corrugation cross section are assumed to be identical circular arcs. The following four kinds of discrete attachment at the corrugation ends are considered in the analysis: (1) point attachments in the troughs, (2) point attachments at the crests and in the troughs, (3) point attachments at mid-height, and (4) point attachments at mid-height, at the crests, and in the troughs. Author

N72-25903*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: LUNAR MODULE LANDING GEAR SUBSYSTEM
William F. Rogers Washington Jun. 1972 58 p refs
(NASA-TN-D-6850; MSC-S-316) Avail: NTIS HC $3.00 CSCL 20K

The development of the lunar module landing gear subsystem through the Apollo 11 lunar landing mission is presented. The landing gear design evolved from the design requirement, which had to satisfy the structural, mechanical, and landing performance constraints of the vehicle. Extensive analyses and tests were undertaken to verify the design adequacy. Techniques of the landing performance analysis served as a primary tool in developing the subsystem hardware and in determining the adequacy of the landing gear for toppling stability and energy absorption. The successful Apollo 11 lunar landing mission provided the first opportunity for a complete flight test of the landing gear under both natural and induced environments. Author

N72-25904*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF ECCENTRICITIES AND LATERAL PRESSURE ON THE DESIGN OF STIFFENED COMPRESSION PANELS
Gary L. Giles and Melvin S. Anderson Washington Jun. 1972 35 p refs
(NASA-TN-D-6784; L-6547) Avail: NTIS HC $3.00 CSCL 20K

An analysis for determining the effects of eccentricities and lateral pressure on the design of stiffened compression panels is presented. The four types of panel stiffeners considered are integral, zee, integral zee, and integral tee. Mass-strength curves, which give the mass of the panel necessary to carry a specified load, are given along with related design equations needed to calculate the cross-sectional dimensions of the minimum-mass-stiffened panel. The results of the study indicate that the proportions of the panels are geometrically similar to the proportions of panels designed for no eccentricity or lateral pressure, but no cross-sectional dimensions are greater, resulting in significantly increased mass. The analytical minimum-mass designs of zee-stiffened panels are compared with designs from experimentally derived charts. An assumed eccentricity of 0.001 times the length of the panel is used to correlate the analytical and experimental data. Good correlation between the experimentally derived and the analytical curves is obtained for the range of loading where materials yield governs the design. At lower loads the mass given by the analytical curve using this assumed eccentricity is greater than that given by the experimental results. Author

N72-25905# Waterloo Univ. (Ontario). Div. of Solid Mechanics.
CREEP AND FATIQUE FRACTURE BEHAVIOUR OF INCONEL ALLOY X-750
P. K. Venkiteswaran, D. C. Ferguson, and D. M. R. Taplin Oct. 1971 31 p refs Sponsored by Natl. Res. Council and Defence Res. Board of Canada
(TN-11) Avail: NTIS HC $3.75

The fracture behaviour of 4 different grain sizes of Inconel alloy X-750 under conditions of constant strain rate tests in the temperature range 450 - 850 deg and constant load creep tests at 700 C in the stress range 30,000 - 60,000 psi is discussed. Combined creep-fatigue tests have been conducted on 113 micron grain size at 700 C. Axial creep-fatigue tests were also made on 3 of the above grain sizes at 700 C under a mean stress of 60,000 psi and a superimposed axial fatigue stress of plus or minus 44,000 psi. Some tests were also performed at 780 C. It was found that fracture was ductile at low temperatures, intergranular at intermediate temperatures and a mixture of intergranular and plastic tearing types at high temperatures. This behaviour was accompanied by higher ductilities at lower and higher temperatures, and lower ductilities at intermediate temperatures. Cavity nucleation was observed as early as 1% of the material creep rupture life. Author

N72-25906# Grumman Aerospace Corp., Bethpage, N.Y.
BUCKLING ANALYSIS OF SHUTTLE DISPOSABLE LIQUID HYDROGEN TANK WITH FLOATING RINGS
R. Winter May 1972 27 p refs
(RM-540) Avail: NTIS HC $3.50

A scheme for treating so-called floating rings is recommended for use in the buckling analysis of stiffened cylindrical shells. Critical stresses are calculated and compared to those for integral rings, for a design representative of the unpressurized Space Shuttle liquid hydrogen tank. The ring rigidity required to prevent general instability is found to be much less than that required by the Shanley criterion, with a correspondingly significant weight saving. There is very little difference in total shell weight between floating and internal integral rings for equal strength designs. Author

N72-25907# Lockheed Missiles and Space Co., Palo Alto, Calif.
VIBRATIONS AND STABILITY OF SHELL FLUID SYSTEMS AND THE GAS FLOWING THROUGH THEM
N. A. Kilchevskii 1970 36 p refs Transl. into ENGLISH from

the book "Mekhanika Sistem Obolochka Zhidkost Nagretyi Gaz" Naukova Dumka, Kiev, 1970 p 72-118
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the vibrations and stability of fluid filled shells and the gas flowing through them is presented. The shell is a circular cylinder with hinged and moving endfaces within which there is a steady motion of a viscous incompressible fluid. The stability problem of the motion of such a shell in a nonlinear formulation reduces to the solution of the combined system of nonlinear partial differential equations. Mathematical models are included to support the theoretical considerations. Author

N72-25908# Institut National de Recherche et de Securite pour la Prevention des Accidents du Travail et des Maladies Professionnelles, Vandoeuvre (France). Service de Physique.
VIBRATION AND AERIAL NOISE OF A ROTATING DISK. FREQUENCY SHIFT OF MECHANICAL VIBRATIONS DUE TO DOPPLER EFFECT: APPLICATION TO CIRCULAR SAW
M. T. Ho and P. Mistrot Oct. 1971 22 p refs In FRENCH (INRS-14/RE-A) Avail: NTIS HC $3.25

The noise spectra of a rotating disk are analyzed. It is shown that the resonant frequencies of the disk at rest are not included in the spectrum but that each of the natural frequencies of the disk at rest is divided in two frequencies in the spectrum of the rotating disk. This is explained by the Doppler effect. As an application the problem of noise reduction of circular saws is discussed. Author (ESRO)

N72-25909# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
DEVELOPMENT OF LIGHTWEIGHT RIGID SOLAR PANELS. DESIGN STUDY Final Report
D. E. Koelle and W. Schaefer Dec. 1971 145 p refs (Contract ESTEC-1369-71-CG)
(ESRO-CR(P)-79; MBB-UR-V-48) Avail: NTIS HC $9.25

A design study for different concepts of three interconnected rectangular rigid panels for solar arrays is presented. Among the topics are the panel concept alternatives, panel design optimization, panel fabrication and technology, stowage and deployment of panel array, and detailed analysis of selected panel concepts (static/dynamic response, thermal behavior, and failure analysis). It was concluded that an improved composite sandwich panel consisting of an Al-core and carbon fiber cover sheets was a suitable compromise between three panel types investigated. ESRO

N72-25910# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
ON WAVE PROPAGATION IN TRUNCATED CONICAL SHELLS. VOLUME 1: ELASTIC-PLASTIC WAVES GENERATED BY AXIAL IMPACT, VOLUME 1 Technical Report, Dec. 1968 - Jul. 1971
B. Albrecht, W. E. Baker, and M. Valathur Dec. 1971 134 p refs
(Contract F29601-69-C-0023)
(AD-737100; AFWL-TR-71-103-Vol-1) Avail: NTIS CSCL 19/1

The propagation of elastic-plastic waves in truncated conical shells was studied. A theory of wave propagation based on the method of characteristics was developed. It involves the solution of the deformation equations by integration along the characteristics. A computer program for the CDC 6600 has been written and the predictions of the theory are in good agreement with the experimental results in both the elastic and the inelastic range. Waves in the shells are generated by axially impacting hard-wired stationary shells with sufficiently large flat-faced cylindrical projectiles. Strain histories at a number of stations along the shell were measured and recorded for comparison with the theoretical values. The experimental work covered impact speeds from 120 to 8,625 feet per second. Author (GRA)

N72-25763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRUCTURAL-THERMAL-OPTICAL PROGRAM (STOP)
H. P. Lee *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 36-40 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20K

N72-25530# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF CRACKS ON THE STRENGTH OF HIGH-STRENGTH SHEET STRUCTURAL MATERIALS
S. Ye. Belyayev *In its* Cold Resistance of Steel and Steel Struct. 23 May 1972 p 19-31 refs (See N72-25527 16-17)
Avail: NTIS HC $4.75

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-25911* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ABLATIVE SYSTEM Patent
Vernon H. Gray, inventor (to NASA) Issued 18 Apr. 1972 4 p Filed 17 Jun. 1970 Supersedes N70-35687 (08 - 19, p 3645)
(NASA-Case-LEW-10359; US-Patent-3,656,317;
US-Patent-Appl-SN-47063; US-Patent-Class-62-467;
US-Patent-Class-60-200A; US-Patent-Class-60-265;
US-Patent-Class-60-267; US-Patent-Class-102-105) Avail: US Patent Office CSCL 20M

A carrier liquid containing ablative material bodies is supplied to a plenum chamber, one wall of which has openings and is exposed to a high temperature environment. The liquid and bodies pass through the openings in the wall to form a self-replacing ablative surface. In another embodiment the wall comprises honeycomb layers. Spheres containing albative whiskers of wads, and a hardening catalyst for the carrier liquid are dispersed in the liquid. Another version utilizes wicks woven of ablative material fibers, and extending through the openings in the wall and into the plenum chamber containing the carrier liquid. Official Gazette of the U.S. Patent Office

N72-25912 Tulane Univ., New Orleans, La.
THE SAMPLING AND ANALYSIS OF A TRACER GAS IN THE COMBUSTION CHAMBER OF A LIQUID ROCKET ENGINE Ph.D. Thesis
Fred Paul Partus 1971 72 p
Avail: Univ. Microfilms Order No. 71-27301

Measurements determining concentration data of an injected tracer gas (helium) within the combustion chamber of a rocket were carried out using the technique of probe sampling, followed by analysis. Concentration distributions of helium were determined at two sampling stations along the longitudinal axis of a rocket. The analysis system consisted of water-cooled sampling probe, a gas chromatograph, and a Burrell gas analyzer. Data were taken from a 300-pound-thrust liquid fuel rocket engine which operated at a chamber pressure of 300 psia. Heptane and liquid oxygen were used as the propellants and a single element like-on-like injector was used. The distributions obtained at each cross section were similar to normal distributions, and the concentrations obtained after re-sampling and analysis at a specific data location were repeatable. Dissert. Abstr.

N72-25913* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
BURN RATE TESTING APPARATUS Patent

Frederick S. Dawn and William L. Gill, inventors (to NASA) Issued 30 May 1972 9 p Filed 28 Aug. 1969 Supersedes N70-12625 (08 - 02, p 0385)
(NASA-Case-XMS-09690; US-Patent-3,665,750; US-Patent-Appl-SN-853641; US-Patent-Class-73-15R) Avail: US Patent Office CSCL 20M

A test apparatus for determining the burn rate between two separated materials is described. The device consists of a gas burner which applies a flame to the material being tested at a specific angle and under timed conditions. The rate of burn through is also tested as a measure of flammability. Provision is also made for testing in various environments. Photocells are used as the device for sensing the burning rate. P.N.F.

N72-25914 Utah Univ., Salt Lake City.
LIMITING AMPLITUDE CALCULATIONS IN SOLID ROCKET COMBUSTION INSTABILITY Ph.D. Thesis
Peter Edward Gibbs 1971 71 p
Avail: Univ. Microfilms Order No. 71-25042

A solution is presented for the nonlinear equations of motion for a gas in a solid propellant rocket motor. A single-phase gas in a combustion chamber is assumed. The combustion process is modeled with an admittance function and a general dissipation term is carried to take care of frictional losses. A single oscillation frequency was introduced and the oscillation envelope solved for. A perturbation expansion was performed, and the linear solution was obtained from the first term in the expansion. The first nonlinear term was calculated from the second term in the expansion in epsilon. A numerical evaluation was done for this term assuming a longitudinal oscillation mode in a cylindrical cavity. All the harmonics of one oscillation mode were included and the interaction among them was calculated. The linear solution is shown valid and identical for all harmonics. The nonlinear solution has the same form, but the coefficients are combinations of interactions among the velocities and pressures of different harmonics. This solution was also evaluated for the case of a cylindrical chamber with a longitudinal oscillation and its harmonics. Dissert. Abstr.

N72-25915*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
MATHEMATICAL MODELING OF HIGH AND LOW TEMPERATURE HEAT PIPES Final Report
S. W. Chi Dec. 1971 94 p refs
(Grant NGR-09-010-070)
(NASA-CR-126739) Avail: NTIS HC $6.75 CSCL 20M

Mathematical models are developed for calculating heat-transfer limitations of high-temperature heat pipes and heat-transfer limitations and temperature gradient of low temperature heat pipes. Calculated results are compared with the available experimental data from various sources to increase confidence in the present math models. Complete listings of two computer programs for high- and low-temperature heat pipes respectively are appended. These programs enable the performance of heat pipes with wrapped-screen, rectangular-groove or screen-covered rectangulargroove wick to be predicted. Author

N72-25916*# Grumman Aerospace Corp., Bethpage, N.Y.
THERMAL TEST PLAN FOR LARGE VARIABLE CONDUCTANCE HEAT PIPE
F. Edelstein 24 Nov. 1971 15 p
(Contract NAS8-27793)
(NASA-CR-123652; HPM-2) Avail: NTIS HC $3.00 CSCL 20M

The procedure to be followed in determining the thermal performance of a variable conductance heat pipe is documented. The nominal one-inch-diameter aluminum pipe is of a cold reservoir type whose overall length is nine feet. It has a capacity of 2 to 4 kW's equivalent to 8 to 16 kW-ft and an overall temperature control range of 50 to 95 F. Initial tests will be conducted with the pipe charged with ammonia to determine its capacity limits. Following introduction of the noncondensible gas (nitrogen), the variable conductance features of the pipe will be used. Author

N72-25917*# Ohio State Univ. Research Foundation, Columbus.
RADIATIVE TRANSFER EFFECTS BEHIND REFLECTED SHOCK WAVES Final Report, 1 Mar. 1968 - 28 Feb. 1972
Robert M. Nerem 13 Mar. 1972 48 p refs
(Grant NGL-36-008-106; RF Proj. 2601)
(NASA-CR-126726; Rept-13) Avail: NTIS HC $4.50 CSCL 20M

Theoretical studies are reported which were largely centered on the nonequilibrium coupling of collisional, ionization, and radiative transfer processes behind reflected shock waves in nitrogen. Experimental studies included broad-band photomultiplier radiative intensity measurements, luminosity photographs of the reflected shock wave front, end-wall heat transfer measurements, and reflected shock velocity time-history measurements. The results of these activities are summarized, and comparisons between the theoretical and experimental results are discussed. Author

N72-25918# Rome Univ. (Italy).
AN EXPERIMENTAL METHOD FOR MEASURING HEAT TRANSFER IN HYPERSONIC AERODYNAMIC MODELS [UN METODO SPERIMENTALE PER LA MISURA DEI FLUSSI DI CALORE NEGLI IMPIANTI AERODINAMICI IPERSONICI]
Ugo Ponzi Nov. 1970 15 p refs In ITALIAN; ENGLISH summary
(Rept-32) Avail: NTIS HC $3.00

Starting with the conductive heat transfer theory according to Broglio's formula, an experimental method is obtained for measuring the heat transfer rate on a hypersonic model. With this method, knowing the N(2) influence coefficients, and the time functions, which can be determined by applying the known heat rate to the model, the heat rates are determined by measuring the temperatures in N points of the model. The method yields the heat transfer rates directly from the temperature measurement. Author

N72-25919# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
REVIEW OF IGNITION SYSTEMS. 2: THE IGNITION OF GUNPOWDER [BEOORDELING VAN ONSTEKINGS-SYSTEMEN. 2: DEONTBRANDING VAN KRUIT]
T. L. vanWaart 1 Dec. 1971 22 p refs In DUTCH
(TL-1971-16; TDCK-59099) Avail: NTIS HC $3.25

The feasibility of forced convection ignition tests for cylindrical shaped solid ammunition samples in hot gas jets is considered. Results from combustion measurements on various samples show: (1) a maximum gas temperature of 676 C is too low to obtain sufficient ignition times; (2) powder particles of 10 microns diameter do not shorten ignition time in the gas jet; (3) measured ignition time spread is too large; and (4) reproducibility of measurement series is very low. It is concluded that measurements obtained by this method cannot be used to evaluate powder ignition effectiveness. Transl. by G.G.

N72-25920# Technological Lab. RVO-TNO, Rijswijk (Netherlands).
REVIEW OF IGNITION SYSTEMS. 3: ALTERNATIVE METHODS FOR THE RESEARCH OF GUNPOWDER IGNITION [BEOORDELING VAN ONTSTEKINGS-SYSTEMEN. 3: ALTERNATIEVE METHODEN VOOR HET ONDERZOEK VAN DE ONTBRANDING VAN KRUIT]
T. L. vanWaart 7 Dec. 1971 12 p refs In DUTCH
(TL-1971-17; TDCK-059100) Avail: NTIS HC $3.00

The various methods for ignition of solid ammunition are compared by evaluating their thermodynamic and gas dynamic properties. Considered are hot gas jets, shock waves, radiative transfer, electrical conduction, and pressure effects. Transl. by G.G.

N72-25921*# Miami Univ., Coral Gables, Fla. Mechanical Engineering Dept.
STATISTICAL STUDY OF THERMAL CONTACT CONDUCTANCE
Veziroglu T. Nejat Jun. 1972 28 p refs
(Grant NGR-10-007-010)
(NASA-CR-126743) Avail: NTIS HC $3.50 CSCL 20M

A theoretical analysis of the principles of interfacial thermal conductance between two heated metal surfaces in mutual contact is presented. It was determined that when heat flows from one metal to the other, the flow lines converge toward the actual contact points since the thermal conductivities of the metals are much greater than any intervening medium such as air or fluids. The converging lines cause contact resistance, which is usually high compared to the resistances offered to heat flow by metals. The resultant variation in resistance can produce unreliable equipment for aerospace and industrial applications unless the conductance can be determined accurately. P.N.F.

N72-25922*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: THERMAL PROTECTION FROM ENGINE-PLUME ENVIRONMENTS
J. Thomas Taylor Washington Jun. 1972 25 p refs
(NASA-TN-D-6844; MSC-S-293) Avail: NTIS HC $3.00 CSCL 21B

Portions of the combined Apollo spacecraft (the command and service module and the lunar module) are subjected to the impingement of hot exhaust gases from the various propulsion systems of the modules. The configurations of the vehicles and the sources of impinging engine plumes are described. A typical Apollo mission is outlined. Protection and design-verification methods are discussed. Finally, recommendations are made for future spacecraft programs. Author

N72-25923*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: AEROTHERMODYNAMICS EVALUATION
Dorothy B. Lee Washington Jun. 1972 18 p refs
(NASA-TN-D-6843; MSC-S-287) Avail: NTIS HC $3.00 CSCL 20M

The Apollo program offered the first opportunity to obtain aerothermodynamic measurements at superorbital velocities on full-scale spacecraft. Four unmanned flight tests were conducted to qualify the Apollo command module heat shield. Aerothermodynamic measurements were made, and data are presented to illustrate the comparison of the flight data with the ground-test results and theoretical predictions. Author

N72-25924*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF PHASE-CHANGE COATINGS FOR VARIABLE THERMAL CONTROL OF SPACECRAFT
Warren C. Kelliher and Philip R. Young Washington Jun. 1972 20 p refs
(NASA-TN-D-6756; L-6283) Avail: NTIS HC $3.00 CSCL 20M

An investigation was conducted to determine the feasibility of producing a spacecraft coating system that could vary the ratio of its solar absorptance to thermal emittance to adjust automatically for changes in the thermal balance of a spacecraft. This study resulted in a new concept called the phase-change effect which uses the change that occurs in the optical properties of many materials during the phase transition from a crystalline solid to an amorphous material. A series of two-component model coatings was developed which, when placed on a highly reflecting substrate, exhibited a sharp decrease in solar absorptance within a narrow temperature range. A variable thermal control coating can have a significant amount of temperature regulation with the phase-change effect. Data are presented on several crystallite-polymer formulations, their physical and optical properties, and associated phase-change temperatures. Aspects pertaining to their use in a space environment and an example of the degree of thermal regulation attainable with these coatings is also given. Author

N72-25925*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON DIMENSIONAL LINE RADIATIVE TRANSFER
K. G. Harstad 1 Apr. 1972 18 p refs
(Contract NAS7-100)
(NASA-CR-126965; JPL-TM-33-538) Avail: NTIS HC $3.00 CSCL 20M

Integrations over solid angle and frequency are performed in the expressions for the radiant heat flux and local energy loss of a line in a region of strong variations of the source function in one direction. Approximations are given for coefficients and kernels in the resulting forms which involve integrals over the physical coordinate. Author

N72-25926# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF A NONSTATIONARY COMBUSTION MODE OF A CONDENSED SYSTEM
V. S. Berman, S. S. Novikov, and Iu. S. Riazantsev [1972] 9 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 1, 1972 p 23-30
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A one-dimensional combustion process for a powder sample on a metal substrate under constant pressure is examined on the basis of a two-phase model for the thermal decomposition of a condensed system. Results are presented of a numerical analysis using an electronic computer. It was established that a fine layer of unconsumed powder, whose thickness depends on the pressure and initial temperature, remains on the plate after combustion ceases. The relationship between the thickness of the unconsumed residue and the pressure and temperature of the initial conditions has been established. Author

N72-25927# Sandia Labs., Albuquerque, N.Mex.
ELEVENTH INTERNATIONAL THERMAL CONDUCTIVITY CONFERENCE
1971 175 p refs Conf. held at Albuquerque, 28 Sep. - 1 Oct. 1971; sponsored by Sandia Labs., Los Alamos Scientific Lab., and New Mexico Univ. Sponsored by AEC
(Conf-710938) Avail: NTIS

The proceedings of a conference on thermal conductivity are presented. Subjects discussed are: (1) heat pipe technology, (2) thermal conductivity of single crystal europium monoxide, (3) in-pile thermal conductivity measurements on oxide fuels for nuclear reactors, (4) determination of high temperature enthalpies of some high boron compounds, (5) flash diffusivity in cylindrical coordinates, (6) thermal conductivity of eight aerospace metals and alloys, (7) thermal conductivity of uranium-plutonium oxides, and (8) electrical resistivity of high purity tungsten at elevated temperatures. Author

N72-25764*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-DIMENSIONAL FINITE-ELEMENT TEMPERATURE VARIANCE ANALYSIS
J. S. Heuser *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 41-44 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20M

N72-25789*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL THERMAL MECHANICS OF DEPLOYABLE BOOM STRUCTURES
Roamer Predmore *In its* Significant Accomplishments in Technol., GSFC, 1970 1972 p 140-144 (See N72-25755 16-30)
Avail: NTIS HC $3.00 CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-25928*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL TESTS OF RELATIVISTIC GRAVITATION THEORIES
John D. Anderson 31 Dec. 1971 25 p refs
(Contract NAS7-100)
(NASA-CR-126746) Avail: NTIS HC $3.25 CSCL 14B

Experimental tests were studied for determining the potential uses of future deep space missions in studies of relativistic gravity. The extensions to the parametrized post-Newtonian framework to take explicit account of the solar system's center of mass relative to the mean rest frame of the Universe is reported. Discoveries reported include the Machian effects of motion relative to the universal rest frame. Summaries of the JPL research are included. F.O.S.

N72-25929# Committee on Science and Astronautics (U. S. House).
BRIEFINGS, BEFORE THE TASK FORCE ON ENERGY OF SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT, VOLUME 2
Washington GPO 3 May 1972 185 p refs Presented to the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 28 Mar. 1972
Avail: Subcomm. on Sci., Res., and Develop.

Briefings are presented on energy sources, resources, and research. Topics considered include the management and use of energy resources, transmission systems and networks, analysis and synthesis of energy systems, research opportunities and energy research needs, nuclear power, coal gasification, optimum uses of energy sources, and satellite solar power stations and power generation. K.P.D.

N72-25930# Defence Research Board, Ottawa (Ontario).
[DEFENSE RESEARCH PROJECTS]
1971 98 p In FRENCH and ENGLISH
(DR-214) Avail: NTIS HC $7.00

A review of the research work carried out during 1971 at the Defense Research Board of Ottawa is outlined along with data from its seven research establishments across Canada. Data cover environmental medicine, industrial research, laser and armament research, and underwater acoustics. Author

N72-25931# Committee on Science and Astronautics (U. S. House).
AN INVENTORY OF ENERGY RESEARCH
Washington GPO Mar. 1972 631 p Presented to Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., Mar. 1972 Sponsored by NSF Prepared by ORNL for Task Force on Energy of Subcomm. on Sci., Res., and Develop.
Avail: Subcomm. on Sci., Res., and Develop.

The indexes for Volume 1 are presented and include: simple index on research institutes, simple index on sponsors, simple index on principal investigators, and permuted index on titles. F.O.S.

N72-25932# Committee on Appropriations (U. S. House).
HUD-SPACE-SCIENCE-VETERANS APPROPRIATIONS FOR 1973, PART 1
Washington GPO 1972 1865 p Hearings before Comm. on Appropriations, 92d Congr., 1st Sess., Feb. - Mar. 1972
Avail: Subcomm. of the Comm. on Appropriations

Proceedings are presented for appropriations for 1973 for housing and urban development, space science, and the Veterans' Administration. Testimony is recorded for representatives of the National Aeronautics and Space Administration, the National Aeronautics and Space Council, the National Science Foundation, the Office of Science and Technology, the Renegotiation Board, and the Securities and Exchange Commission. K.P.D.

N72-25933# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1973 (REPORT OF THE COMMITTEE ON AERONAUTICAL AND SPACE SCIENCES, UNITED STATES SENATE, TOGETHER WITH ADDITIONAL VIEWS ON H.R. 14070) An act to authorize appropriations
Washington GPO 1972 108 p refs Rept. on H.R. 14070 presented by Comm. on Aeron. and Space Sci. at the 92d Congr., 2d Sess., 3 May 1972
(S-Rept-92-779) Avail: US Capitol, Senate Document Room

Appropriations are considered for NASA research and development, the construction of facilities, research and program management, and other purposes. G.G.

N72-25934# Committee on Science and Astronautics (U. S. House).
SCIENCE POLICY: A WORKING GLOSSARY
Franklin P. Huddle (Library of Congr.) Washington GPO Apr. 1972 63 p refs Presented to Comm. on Sci. and Astron., 92d Congr., 2d Sess., Apr. 1972 Prepared by Library of Congr.
Avail: Subcomm. on Sci., Res., and Develop.

Definitions are given for terms commonly associated with science policy and its study. The history of science policy and the scope and limitations of the glossary are considered briefly. K.P.D.

N72-25935# RAND Corp., Santa Monica, Calif.
THE JOSS YEARS: REFLECTIONS ON AN EXPERIMENT
Shirley L. Marks Dec. 1971 55 p refs
(R-918) Avail: NTIS HC $4.75

JOSS, the JOHNNIAC Open-Shop System, was proposed in March 1961 as an exploration into continuous and intimate contact between a human user and a computer. This personal time-shared computing service initiated the first phase of the Air Force-sponsored Information Processor Project, whose goal was to improve communication between man and machine. JOSS was designed for solution of the small numerical problem. Typical JOSS interaction is displayed by the physical indicators on the console and exemplified by the process of creating and modifying programs. The readability of the ENGLISH-like commands and messages contributes to easy creation and modification. Such console and language characteristics have enhanced the personalized, open-shop approach to computing power for the nonprogrammer. Author

N72-25936# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1973, PART 1
Washington GPO 1972 808 p Hearings on S. 3094 before Comm. on Aeronaut. and Space Sci., 92d Congr., 2d Sess., 14-16 Mar. 1972
Avail: Comm. on Aeronaut. and Space Sci.

Hearings of the Committee on Aeronautical and Space Sciences of the United States Senate to determine NASA authorization for fiscal year 1973 are presented. The bill authorized appropriations to NASA for research and development, construction of facilities, and program management. The areas in which NASA applies the funds are described and the amounts of money required are identified. P.N.F.

N72-25937# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1973, PART 2
Washington GPO 1972 555 p refs Hearings on S. 3094 before Comm. on Aeronaut. and Space Sci., 92d Congr., 2d Sess., 22-23 Mar. and 12 and 14 Apr. 1972
Avail: SOD $2.50

The hearings of the Committee on Aeronautical and Space Sciences of the United States Senate to determine the NASA authorization for fiscal year 1973 are presented. The statements submitted by scientific personnel in NASA and other governmental agencies concerning government funded research and development projects are included. Emphasis is placed on global tracking network funding and space shuttle development. The requirements of the Deep Space Network are analyzed. Comparison is made between the U.S. and Soviet civilian and military space effort. P.N.F.

N72-25938# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1973, PART 2
Washington GPO 1972 892 p ref Hearings on H.R. 12824 (superseded by H.R. 14070) before Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., No. 15, 17, 22, 24 Feb. and 1, 2, 8, 9, 14, and 16 Mar. 1972
Avail: Comm. on Sci. and Astronaut.

The most significant parts of the manned space flight budget request for fiscal year 1973 are projected with emphasis on the space shuttle development. Considered are the Apollo program, development test and mission operations, Skylab, life sciences, orbital systems and advanced missions, and research and development for missions operation and management. G.G.

N72-25939# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1973, PART 3
Washington GPO 1972 467 p Hearings on H.R. 12824 (superseded by H.R. 14070) before Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., No. 15, 17, 22, 24, 29 Feb. and 1, 2, 7-9, and 14 Mar. 1972
Avail: Subcomm. on Space Sci. and Appl.

The Science and Astronautics Committee held hearings on the NASA authorization bill for fiscal 1973. The proposed use of monies in research and development, space exploration, and operational procedures is outlined. E.H.W.

N72-25940# Committee on Science and Astronautics (U. S. House).
NATIONAL BUREAU OF STANDARDS: REVIEW OF ITS ORGANIZATION AND OPERATIONS
Dorothy M. Bates, comp. (Library of Congr.), Warren H. Donnelly, comp. (Library of Congr.), and Charles S. Sheldon, II, comp. (Library of Congr.) Washington GPO 8 Sep. 1971 231 p refs Presented to the Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., 10 Sep. 1971 Prepared by Library of Congr.
Avail: Subcomm. on Sci., Res., and Develop.

The organization, personnel, funding, and facilities of the National Bureau of Standards are discussed. The activities of the Bureau and various problems and issues facing it in the future are considered. Means of improving the Bureau's capability of meeting emerging needs are also presented. K.P.D.

N72-25941# Committee on Science and Astronautics (U. S. House).
NEW TECHNOLOGY IN EDUCATION; SELECTED REFERENCES
Lilla M. Pearce, comp. (Library of Congr.) and Helen A. Miller, comp. (Library of Congr.) Washington GPO Sep. 1972 145 p refs Presented to the Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., 4 Sep. 1971 Prepared by Library of Congr.
Avail: Subcomm. on Sci., Res., and Develop.

A reference bibliography is presented on three major topics: educational technology and its issues, problems, and future uses; use of specific media in education; and alternative methods to the organization of instruction. K.P.D.

N72-25942# Committee on Science and Astronautics (U. S. House).
SELECTED READINGS ON SCIENCE, TECHNOLOGY, AND THE ECONOMY
Edward Knight, comp. (Library of Congr.), Steven Wolf, comp. (Library of Congr.), and Warren H. Donnelly, comp. (Library of Congr.) Washington GPO Oct. 1971 98 p refs Presented to Comm. on Sci. and Astronaut., 92d Congr., 1st Sess., 1 Oct. 1971 Prepared by Library of Congr.
Avail: Subcomm. on Sci., Res., and Develop.

Readings on science, technology, and the economy are presented. Relevant parts of the President's economic policy are discussed which deal with research, development, and foreign trade. K.P.D.

N72-25943# Committee on Appropriations (U. S. House).
MILITARY CONSTRUCTION APPROPRIATIONS FOR 1972. PART 1: FAMILY HOUSING, OFFICE OF THE SECRETARY OF DEFENSE
Washington GPO 1971 493 p refs Hearing before Comm. on Appropriations, 92d Congr., 1st Sess., 24 Mar. 1971
Avail: Subcomm. on Mil. Construct. Appropriations

Hearings before the House Committee on the budget request for military construction and family housing for FY 1972 are presented. Estimated costs associated with constructions of each service and agency and of the Office of the Secretary of Defense are discussed. Safeguard construction and community impact are also mentioned. N.E.N.

N72-25944# Committee on Appropriations (U. S. House).
MILITARY CONSTRUCTION APPROPRIATIONS FOR 1972. PART 3: ARMY, CONTINGENCY FUND, DEFENSE AGENCIES, LANGUAGE CHANGES, RESERVE AND GUARD, SAFEGUARD SYSTEM, STATUS OF CONSTRUCTION IN SOUTHEAST ASIA, STATUS OF FUNDS
Washington GPO 1971 618 p refs Hearing before Comm. on Appropriations, 92d Congr., 1st Sess., 14 Jun. 1971
Avail: Subcomm. on Mil. Construct. Appropriations

Hearings before the House Committee on the Army's military construction program for FY 1972 are presented. Details on the Safeguard System construction plans and those of the Defense Agencies are included. N.E.N.

N72-25945# Committee on Science and Astronautics (U. S. House).
AERONAUTICAL RESEARCH AND DEVELOPMENT
Washington GPO 1972 947 p refs Hearings before Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., No. 17, 18-20 Jan. 1972
Avail: Subcomm. on Aeron. and Space Technol.

The hearings concerning aeronautical research are reported. Topics discussed include: civil aviation R and D (CARD), national transportation policy, industry response to CARD study, aircraft noise abatement, aircraft safety, and short haul aircraft programs. The Airport Operators Council International Policy Handbook is included. F.O.S.

N72-25946# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1972
Washington GPO 1971 1130 p Hearings on H.R. 9667 before Comm. on Appropriations, 92d Congr., 1st Sess., Jun. - Jul. 1971
Avail: Subcomm. of the Comm. on Appropriations

The hearings concerning the appropriations for FY 72 are reported. Budget requests considered include: St. Lawrence Seaway Development, U.S. Coast Guard, Panama Canal, National

Highway Traffic Safety, Washington D.C. Transit, and Civil Aeronautics. F.O.S.

N72-25947# Committee on Commerce (U. S. Senate).
ESTABLISHING THE NATIONAL ADVISORY COMMITTEE ON THE OCEANS AND ATMOSPHERE Report to accompany H.R. 2587
Hollings Washington GPO 30 Jul. 1971 12 p ref Presented by Comm. on Com. to 92d Congr., 1st Sess., 30 Jul. 1971
(S-Rept-92-333) Avail: US Capitol, Senate Document Room

The amendments to the bill recommended by the Committee on Commerce are presented. The purpose, background, and need for the legislation are discussed, and a section by section analysis, an explanation of amendments, and the bill as amended are included. N.E.N.

N72-25948# Committee on Commerce (U. S. Senate).
TRANSPORTATION OF GOVERNMENT TRAFFIC BY CIVIL AIR CARRIERS Report to accompany S. 1821
Cannon Washington GPO 19 Nov. 1971 43 p refs Presented by Comm. on Com. to 92d Congr., 1st Sess., 19 Nov. 1971
(S-Rept-92-503) Avail: US Capitol, Senate Document Room

A report is presented on the bill to amend the Federal Aviation Act with respect to the transportation of Government passengers and cargo, both military and civilian, by U.S. civil air carriers. The provisions and background of the bill are outlined, and the current and anticipated military and civilian needs are discussed. It is concluded that the Military Airlift Command (MAC) aircraft are in excess of those needed for training and readiness maintenance. The net current costs to the Government would be reduced by using civil carriers for cargo transportation instead of MAC carriers. The strategic airlift capability of the Civil Reserve Air Fleet is essential and must be maintained, and the cost of maintaining it by assuring business to the civil carriers is far less than the cost of providing and maintaining equivalent capability in MAC. N.E.N.

N72-25949# Federal Aviation Administration, Washington, D.C.
THE NATIONAL AVIATION SYSTEM POLICY SUMMARY
1972 295 p refs
(Rept-1000.27-App-1) Avail: SOD $2.25

The FAA's national policies are examined, including the broad policies, such as overall mission and objectives, and more specific policies that state the goals, requirements, and criteria for major subsystems. Route control and services, terminal area control and services, flight services, airspace allocation and rules, en route navigation aids, landing aids, system support, airports, manpower and training, and regulatory functions and aviation safety are discussed. Some engineering, development, and investment policies are also considered. J.A.M.

N72-25950# Federal Aviation Administration, Washington, D.C.
THE NATIONAL AVIATION SYSTEM PLAN 1973-1982
1972 245 p refs
(Rept-1000.27-App-2) Avail: SOD $2.00

The national aviation system plan for 1973 through 1982 is part of a creative joint industry-government program. The objectives and planning baselines for this program are discussed, along with cost estimates and plan funding. Various services are also considered, including en route control, terminal area control, and in-flight services. J.A.M.

N72-25951# Committee on Aeronautical and Space Sciences (U. S. Senate).
INTERNATIONAL COOPERATION IN OUTER SPACE: A SYMPOSIUM
Eilene Galloway, ed. (Library of Congr.) Washington GPO 9 Dec. 1971 738 p refs Presented by Comm. on Aeron. and Space to 92d Congr., 1st Sess., 17 Dec. 1971
(S-Doc-92-57) Avail: SOD $3.00

Operating agreements and principles governing international telecommunications satellites and activities in the exploration and use of outer space are presented. Included are legal aspects of international liability for damage caused by space objects, rescue of astronauts, and return of objects launched into space. G.G.

N72-25952# Smithsonian Institution, Washington, D.C.
WILEY POST, HIS WINNIE MAE, AND THE WORLD'S FIRST PRESSURE SUIT, NUMBER 8
Stanley R. Mohler and Bobby H. Johnson 1971 134 p refs
Avail: NTIS HC $8.75

A biography of Wiley Post covering his entire lifetime and accomplishments in the field of aviation is presented. The significant events of his life which are reported are as follows: (1) globe circling flight with Gatty in 1931, (2) solo flight around the world in 1933, (3) development and test of pressure suit for altitude flight, (4) stratosphere flights during 1934 to 1935 time period, and (5) flight to Point Barrow, Alaska with Will Rogers which ended in fatal accident to both men. A large number of photographs are included to supplement the written reports. P.N.F.

N72-25953*# Denver Research Inst., Colo. Industrial Economics Div.
MISSION ORIENTED R AND D AND THE ADVANCEMENT OF TECHNOLOGY: THE IMPACT OF NASA CONTRIBUTIONS, VOLUME 1 Final Report
Martin D. Robbins, John A. Kelley, and Linda Elliott May 1972 71 p refs
(Contract NSR-06-004-063)
(NASA-CR-126561) Avail: NTIS HC $5.75 CSCL 05B

The contributions of NASA to the advancement of major developments in several selected fields of technology are identified. Subjects discussed are: (1) developing new knowledge, (2) developing new technology, (3) demonstrating the application of new technology for the first time, (4) augmenting existing technology, (5) applying existing technology in a new context, (6) stimulating industry to acquire or develop new technology, (7) identifying problem areas requiring further research, and (8) creating new markets. Author

N72-25954*# Denver Research Inst., Colo. Industrial Economics Div.
MISSION ORIENTED R AND D AND THE ADVANCEMENT OF TECHNOLOGY: THE IMPACT OF NASA CONTRIBUTIONS, VOLUME 2 Final Report
Martin D. Robbins, John A. Kelley, and Linda Elliott May 1972 358 p refs
(Contract NSR-06-004-063)
(NASA-CR-126562) Avail: NTIS HC $20.00 CSCL 05B

NASA contributions to the advancement of major developments in twelve selected fields of technology are presented. The twelve fields of technology discussed are: (1) cryogenics, (2) electrochemical energy conversion and storage, (3) high-temperature ceramics, (4) high-temperature metals (5) integrated circuits, (6) internal gas dynamics (7) materials machining and forming, (8) materials joining, (9) microwave systems, (10) nondestructive testing, (11) simulation, and (12) telemetry. These field were selected on the basis of both NASA and nonaerospace interest and activity. Author

N72-25955*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICABILITY OF NASA CONTRACT QUALITY MANAGEMENT AND FAILURE MODE EFFECT ANALYSIS PROCEDURES TO THE USGS OUTER CONTINENTAL SHELF OIL AND GAS LEASE MANAGEMENT PROGRAM
Morris K. Dyer, Dewey G. Little, Earl G. Hoard, Alfred C. Taylor, and Rayford Campbell Washington Jun. 1972 43 p refs
(NASA-TM-X-2567) Avail: NTIS HC $3.00 CSCL 05A

An approach that might be used for determining the

applicability of NASA management techniques to benefit almost any type of down-to-earth enterprise is presented. A study was made to determine the following: (1) the practicality of adopting NASA contractual quality management techniques to the U.S. Geological Survey Outer Continental Shelf lease management function; (2) the applicability of failure mode effects analysis to the drilling, production, and delivery systems in use offshore; (3) the impact on industrial offshore operations and onshore management operations required to apply recommended NASA techniques; and (4) the probable changes required in laws or regulations in order to implement recommendations. Several management activities that have been applied to space programs are identified, and their institution for improved management of offshore and onshore oil and gas operations is recommended.
Author

N72-25956# National Science Foundation, Washington, D.C.
FEDERAL FUNDS FOR RESEARCH DEVELOPMENT AND OTHER SCIENTIFIC ACTIVITIES, FISCAL YEARS 1970, 1971, 1972
1972 252 p
(NSF-71-35-Vol-20) Avail: SOD $2.00

Data concerning federal obligations in R and D are presented for FY 1970, 71, and 72. Topics discussed include: federal funds for research, development, and R and D plants; federal funds for scientific technical information; and federal funds for collection of general purpose scientific data. F.O.S.

N72-25957# Committee on Aeronautical and Space Sciences (U. S. Senate).
CONVENTION ON INTERNATIONAL LIABILITY FOR DAMAGE CAUSED BY SPACE OBJECTS: ANALYSIS AND BACKGROUND DATA
Daniel Hill Zafren (Library of Congr.) Washington GPO May 1972 81 p refs Presented by Comm. on Aeron. and Space Sci., 92d Congr., 2d Sess. 3 May 1972 Prepared by Library of Congr. Am. Law Div.
Avail: SOD $0.35

The Congressional hearings on international nonaggressive use of space are discussed. Laws governing the use of space equipment, data obtained from space exploration, and the treatment and return of space explorers and equipment are given. The liability of a nation or nations for damage caused by space objects is outlined. E.H.W.

N72-25958# National Transportation Safety Board, Washington, D.C.
[FUNCTIONS, POWERS, DUTIES, AND CONTRIBUTIONS OF THE NATIONAL TRANSPORTATION SAFETY BOARD]
Isabel A. Burgess 15 Dec. 1972 11 p refs Presented at Luncheon Meeting of the Cleveland Men's Club of Washington, D. C., 15 Dec. 1971
Avail: NTIS HC $3.00

A description is given of the National Transportation Safety Board and its functions in preventing accidents; the powers and duties of the Board are also given. The Board analyzes transportation systems, identifies possible hazards in the system, and offers methods for eliminating these hazards before operation of the system is started. The cause of accidents, and safety recommendations for preventing recurrence of such accidents are investigated and published by the Board. E.H.W.

N72-25959# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 246
25 May 1972 122 p refs Transl. into ENGLISH from various East European periodicals
(JPRS-56106) Avail: NTIS HC $8.25

Articles concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields, are presented. The administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences, are discussed. Author

N72-25960# Committee on Commerce (U. S. Senate).
TRANSPORTATION OF GOVERNMENT TRAFFIC BY CIVIL AIR CARRIERS
Washington GPO 1972 157 p refs Hearing on S. 182 before Comm. on Com., 92d Congr., 1st Sess. 24 Jun. and 30 Sep. 1971
Avail: Subcomm. on Aviation

Hearings by the aviation subcommittee on DOD use of civil aircraft are reported. Civil airlines, holding options on air cargo by the military, want an amendment requiring DOD to transport at least 50% of its air cargo with them. Such an amendment is needed, it was argued, because almost all air cargo is presently being shipped by military means; yet these companies were sold rights to the transportation and are losing money. E.H.W.

N72-25961*# National Aeronautics and Space Administration, Washington, D.C.
GOVERNMENT-INDUSTRY SYSTEM SAFETY CONFERENCE
28 May 1971 283 p refs Conf. held at Greenbelt, Md., 26-28 May 1971
(NASA-TM-X-68369) Avail: NTIS HC $16.25 CSCL 13L

Conference papers are presented relating to all aspects of the systems approach to safety and its application in governmental and industrial projects. For individual titles, see N72-25962 through N72-25988.

N72-25962*# National Aeronautics and Space Administration, Washington, D.C.
COMMUNICATING THE RISK
Raymond M. Wilmotte *In its* Govt.-Ind. System Safety Conf. 28 May 1971 p 23-35 ref (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The balance between benefits and risk is discussed from the standpoint of the decision or policy making process. The basic premise of the discussion is that applied technology may be divided into two parts: (1) benefit oriented technology which includes design, development, manufacturing or construction, and operations; and (2) risk or uncertainty technology which includes safety, reliability, quality assurance, test, and maintenance. Whereas the primary emphasis of the discussion is placed on the importance of a balance in the application of these technologies, arguments are presented which indicate that risk technologies lag far behind benefit technologies. In addition, existing conditions and pressures are described which lead to underestimating risk. The importance is stressed of developing a better sense of the advantages that knowledge of risk could provide via the decision making process. It is suggested that by experiment and analysis on the effects of increasing the contribution of risk technologies, a better understanding of their potentiality and limitations would result. D.L.G.

N72-25963*# Interior Dept., Washington, D.C. Div. of Safety Management.
SYSTEM SAFETY MANAGEMENT: A NEW DISCIPLINE
W. C. Pope *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 37-40 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The systems theory is discussed in relation to safety management. It is suggested that systems safety management, as a new discipline, holds great promise for reducing operating errors, conserving labor resources, avoiding operating costs due to mistakes, and for improving managerial techniques. It is pointed out that managerial failures or system breakdowns are the basic reasons for human errors and condition defects. In this respect, a recommendation is made that safety engineers stop visualizing the problem only with the individual (supervisor or employee) and see the problem from the systems point of view.
D.L.G.

N72-25964*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DATA REQUIREMENTS ANALYSIS IN SUPPORT OF SYSTEM SAFETY
Irving Pinkel *In its* Govt.-Ind. System Safety Conf. 28 May 1971 p 41-47 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The development of a user-oriented safety data bank is reported and its data requirements are outlined. The information retrieval system employed is described along with the problems involved in its establishment and operation. D.L.G.

N72-25965*# National Aeronautics and Space Administration, Washington, D.C.
REFLECTIONS ON SYSTEM SAFETY AND THE LAW
Daniel F. Hayes, Sr. *In its* Govt.-Ind. System Safety Conf. 28 May 1971 p 49-56 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The application of law to the determination of what constitutes safeness is discussed. The numerous factors are analyzed which enter into the decisions of courts in deciding what is safe and what is unsafe. It is pointed out that as technology changes, legal interpretations of safety also change. Arguements are given for the use of system safety techniques and better engineering analyses as instruments of defense against liability. D.L.G.

N72-25966*# Hughes Aircraft Co., Culver City, Calif. Senior Technical Staff.
WHY SYSTEM SAFETY PROGRAMS CAN FAIL
Willie Hammer *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 59-64 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

Factors that cause system safety programs to fail are discussed from the viewpoint that in general these programs have not achieved their intended aims. The one item which is considered to contribute most to failure of a system safety program is a poor statement of work which consists of ambiguity, lack of clear definition, use of obsolete requirements, and pure typographical errors. It is pointed out that unless safety requirements are stated clearly, and where they are readily apparent as firm requirements, some of them will be overlooked by designers and contractors. The lack of clarity is stated as being a major contributing factor in system safety program failure and usually evidenced in: (1) lack of clear requirements by the procuring activity, (2) lack of clear understanding of system safety by other managers, and (3) lack of clear methodology to be employed by system safety engineers. D.L.G.

N72-25967*# Army Board for Aviation Accident Research, Fort Rucker, Ala.
THE PRACTICAL APPLICATION OF MISHAP DATA IN ARMY AIRCRAFT SYSTEM SAFETY PROGRAMS
James T. Darrah, Jr. *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 65-73 ref (See N72-25961 16-3;)
Avail: NTIS HC $16.25 CSCL 13L

The means are discussed by which the the United States Army Board for Aviation Accident Research (USABAAR) now utilizes the vast store of historical accident data in the application of the system safety concept for developmental aircraft. USABAAR serves as the central agency for the Army Accident Prevention Program which includes the receipt, processing, and analysis of all data and information related to Army aircraft accident experience. It is pointed out that methods which served the cause of accident prevention so well in the past are no longer adequate and that traditional parameters used to measure mishap experience have become obsolete. USABAAR has developed, and recently put into use, completely revised accident reporting forms which greatly expand the scope and detail of information provided as a result of investigation. This and other factors which have resulted in an improved data system are discussed in detail. D.L.G.

N72-25968*# Air Registration Board, London (England).
SOME THOUGHTS ABOUT SYSTEM SAFETY ASSESSMENT AND ITS CURRENT APPLICATION IN AEROSPACE
Peter R. Allison *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 75-85 ref (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The various issues and requirements which must be considered during the actual work of safety assessment are discussed. The task and its objectives are considered and the importance of presentation is stressed, so that problems and their solution are displayed adequately to the many disciplines involved. The definition of areas of influence to which the requirements can be applied, and safety objectives derived, is also discussed. Emphasis is placed on the need to determine and set out safety objectives with precision so that the analysis is not complicated with occurrences which are not relevant to safety. D.L.G.

N72-25969*# Martin Marietta Corp., Baltimore, Md.
PILOT SAFETY FOR THE X-24A LIFTING BODY VEHICLE
c02
John Cochrane and Kenneth Graham *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 87-95 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The design and operational characteristics of the X-24A are described in detail. Primary emphasis is placed on the safety considerations incorporated in the design and flight test stages. It is pointed out that the inherently high drag of the lifting body configuration together with its relatively low lift/drag ratio, generated considerable concern with respect to the pilot's ability to perform safe landings from gliding flight. The resulting safety procedures taken at each stage of development are discussed. D.L.G.

N72-25970*# University of Southern Calif., Los Angeles.
SYSTEM SAFETY EDUCATION FOCUSED ON FLIGHT SAFETY
Eugene Holt *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 101-106 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The measures necessary for achieving higher levels of system safety are analyzed with an eye toward maintaining the combat capability of the Air Force. Several education courses were provided for personnel involved in safety management. Data include: (1) Flight Safety Officer Course, (2) Advanced Safety Program Management, (3) Fundamentals of System Safety, and (4) Quantitative Methods of Safety Analysis. E.H.W.

N72-25971*# Texas A&M Univ., College Station.
SYSTEM SAFETY EDUCATION FOCUSED ON INDUSTRIAL ENGINEERING
W. L. Johnston and R. S. Morris *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 108-111 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

An educational program, designed to train students with the specific skills needed to become safety specialists, is described. The discussion concentrates on application, selection, and utilization of various system safety analytical approaches. Emphasis is also placed on the management of a system safety program, its relationship with other disciplines, and new developments and applications of system safety techniques. E.H.W.

N72-25972*# George Washington Univ., Washington, D.C.
SYSTEM SAFETY EDUCATION FOCUSED ON SYSTEM MANAGEMENT
Vernon L. Grose *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 113-126 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

System safety is defined and characteristics of the system are outlined. Some of the principle characteristics include role of humans in hazard analysis, clear language for input and output, system interdependence, self-containment, and parallel analysis of elements. E.H.W.

N72-25973*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CONTRACTING FOR SYSTEM SAFETY
Leslie W. Ball *In its* Govt.-Ind. System Safety Conf. 28 May 1971 p 129-136 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

Data are given concerning the safety requirements that are, or should be, part of the hierachy of the contractual relationship between government and prime contractors, prime and subcontractors, and subcontractors and vendors. Author

N72-25974*# National Transportation Safety Board, Washington, D.C.
REQUIREMENTS FOR SYSTEMS SAFETY PROGRAMS AS DELINEATED BY MIL-STD-882
C. O. Miller *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 137-146 refs (See N72-25961 16-3;)
Avail: NTIS HC $16.25 CSCL 13L

A specialized approach, based on MIL-STD-882, to recommended safety features of an air safety program for aircraft manufacturers, is summarized. E.H.W.

N72-25975*# Boeing Co., Seattle, Wash.
INTEGRATING SYSTEM SAFETY INTO THE BASIC SYSTEMS ENGINEERING PROCESS
John W. Griswold *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 147-160 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The basic elements of a systems engineering process are given along with a detailed description of what the safety system requires from the systems engineering process. Also discussed is the safety that the system provides to other subfunctions of systems engineering. E.H.W.

N72-25976*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE VIKING PROJECT SAFETY PROGRAM
Donald H. Ward *In its* Govt.-Ind. System Safety Conf. 28 May 1971 p 163-169 (See N72-25961 16-34)
Avail: NTIS $16.25 CSCL 13L

The safety requirements and the management of these requirements for the Viking Project are given. Potential hazards are identified and ways of reducing or providing a sound confidence limit are analyzed. E.H.W.

N72-25977*# North American Rockwell Corp., Downey, Calif. Div. Safety.
SYSTEM SAFETY IN THE OPERATIONAL PHASE
John Gera, Sr. *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 171-175 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The operational phase of system safety is investigated. Data cover manufacturing, test operations, materials handling, flight tests, and operational mission analysis. E.H.W.

N72-25978*# Grumman Aerospace Corp., Bethpage, N.Y. LM Safety.
LUNAR MODULE PROGRAM SYSTEM SAFETY
William E. Scarborough *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 177-182 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The application of system safety principles to the Lunar Module Program is summarized. Objectives of the program include elimination or reduction of risk to personnel, material, and facilities resulting from failures or malfunctions in hardware or procedures. Data also cover design, production, and test activity. E.H.W.

N72-25979*# Martin Marietta Corp., Denver, Colo. Systems Safety.
SYSTEM SAFETY IN MANNED VERSUS UNMANNED PROGRAMS
George B. Mumma *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 185-193 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The differences in applying system safety techniques to manned and unmanned spacecraft are outlined. The Skylab Earth Orbiting Laboratory and the Viking Mars Lander were compared. Common aspects, differences, and mission objectives are used as major criteria in developing a safety procedure. E.H.W.

N72-25980*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
THE REDUCTION OF A "SAFETY CATASTROPHIC" POTENTIAL HAZARD: A CASE HISTORY
Joseph P. Jones *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 195-206 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

A worst case analysis is reported on the safety of time watch movements for triggering explosive packages on the lunar surface in an experiment to investigate physical lunar structural characteristics through induced seismic energy waves. Considered are the combined effects of low pressure, low temperature, lunar gravity, gear train error, and position. Control measures constitute a seal control cavity and design requirements to prevent overbanking in the mainspring torque curve. Thus, the potential hazard is reduced to safety negligible. G.G.

N72-25981*# Idaho Nuclear Corp., Idaho Falls. Computer Science Branch.
FAULT TREE APPLICATIONS WITHIN THE SAFETY PROGRAM OF IDAHO NUCLEAR CORPORATION
W. E. Vesely *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 209-219 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

Computerized fault tree analyses are used to obtain both qualitative and quantitative information about the safety and reliability of an electrical control system that shuts the reactor down when certain safety criteria are exceeded, in the design of a nuclear plant protection system, and in an investigation of a backup emergency system for reactor shutdown. The fault tree yields the modes by which the system failure or accident will occur, the most critical failure or accident causing areas, detailed failure probabilities, and the response of safety or reliability to design modifications and maintenance schemes. G.G.

N72-25982*# National Bureau of Standards, Washington, D.C.
CONSUMER PRODUCT SAFETY: A SYSTEMS PROBLEM
Carl C. Clark *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 221-232 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The manufacturer, tester, retailer, consumer, repairer disposer, trade and professional associations, national and international standards bodies, and governments in several roles are all involved in consumer product safety. A preliminary analysis, drawing on system safety techniques, is utilized to distinguish the inter-relations of these many groups and the responsibilities that they are or could take for product safety, including the slow accident hazards as well as the more commonly discussed fast

accident hazards. The importance of interactive computer aided information flow among these groups is particularly stressed.
Author

N72-25983*# National Transportation Safety Board, Washington, D.C. Railroad Safety Div.
APPLICATION OF SYSTEM SAFETY TO RAIL TRANSIT SYSTEMS
Thomas Dew Styles *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 233-239 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

Management emphasis on system safety in the rapid transit industry includes the granting and use of funds by the Federal Government according to systematic analysis of safety hazards in advance. Likelihood predictions that those hazards will be activated by exposure of the system to a system failure, a human error, external conditions, or combinations of these aspects determine alternatives to the assumption of risk and recommend corrections before the system is operational. Rigorous safety analyses are projected to assure operational safety for prolonged periods under varied maintenance conditions; these analysis encompass station accident possibilities as well as train-person collisions, car equipment and design, traffic control systems, and tunnel design problems. G.G.

N72-25984*# National Highway Traffic Safety Administration, Washington, D.C. Office of Operating Systems.
DESIGNING FOR AUTO SAFETY
Elwood T. Driver *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 241-250 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

Safety design features in the motor vehicle and highway construction fields result from systems analysis approach to prevent or lessen death, injury, and property damage results. Systems analysis considers the prevention of crashes, increased survivability in crashes, and prompt medical attention to injuries as well as other postcrash salvage measures. The interface of these system elements with the driver, the vehicle, and the environment shows that action on the vehicle system produces the greatest safety payoff through design modifications. New and amended safety standards developed through hazard analysis technique improved accident statistics in the 70'; these regulations include driver qualifications and countermeasures to identify the chronic drunken driver who is involved in more than two-thirds of all auto deaths. G.G.

N72-25985*# Litton Systems, Inc., Beverly Hills, Calif. Assurance Engineering.
INTEGRATING A MULTIFACETED SYSTEM SAFETY PROGRAM FOR A LARGE COMPLEX SYSTEM
W. W. Malasky *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 251-257 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

A safety systems effectiveness analysis is developed that considers the extent to which a system may be expected to achieve a set of stated system objectives by determining the interrelationships between reliability, maintainability, quality assurance, human factors, and value engineering. G.G.

N72-25986*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
RELIABILITY TECHNIQUES IN THE PETROLEUM INDUSTRY
Henry L. Williams *In its* Govt.-Ind. System Safety Conf. 28 May 1971 p 259-270 (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

Quantitative reliability evaluation methods used in the Apollo Spacecraft Program are translated into petroleum industry requirements with emphasis on offsetting reliability demonstration costs and limited production runs. Described are the qualitative disciplines applicable, the definitions and criteria that accompany the disciplines, and the generic application of these disciplines to the chemical industry. The disciplines are then translated into proposed definitions and criteria for the industry, into a base-line reliability plan that includes these disciplines, and into application notes to aid in adapting the base-line plan to a specific operation. G.G.

N72-25987*# Grumman Aerospace Corp., Bethpage, N.Y.
SYSTEM SAFETY ENGINEERING IN THE DEVELOPMENT OF ADVANCED SURFACE TRANSPORTATION VEHICLES
Harry E. Arnzen *In* NASA, Washington Govt.-Ind. System Safety Conf. 28 May 1971 p 271-292 refs (See N72-25961 16-3;)
Avail: NTIS HC $16.25 CSCL 13L

Applications of system safety engineering to the development of advanced surface transportation vehicles are described. As a pertinent example, the paper describes a safety engineering efforts tailored to the particular design and test requirements of the Tracked Air Cushion Research Vehicle (TACRV). The test results obtained from this unique research vehicle provide significant design data directly applicable to the development of future tracked air cushion vehicles that will carry passengers in comfort and safety at speeds up to 300 miles per hour. Author

N72-25988*# National Aeronautics and Space Administration, Washington, D.C.
OBSERVATIONS AND REFLECTIONS
Jerome Lederer *In its* Govt.-Ind. System Safety Conf. 28 May 1971 p 293-299 refs (See N72-25961 16-34)
Avail: NTIS HC $16.25 CSCL 13L

The aspects of software as well as hardware in application of system safety to nuclear safety, consumer product safety, rail transit safety, auto safety, petroleum safety, and advanced surface transport safety are emphasized. The possibility of product liability as a forcing function to stimulate adoption of system safety analysis is projected. G.G.

N72-25989# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
REPORT ON RESEARCH AND DEVELOPMENT WORK IN THE YEAR 1970
1970 235 p refs In GERMAN
(KFK-1550) Avail: AEC Depository Libraries

Research and development work described emphasizes fast breeder projects, control of fission flux, data processing methods, and new reactor technologies. Reported are studies on environmental control, fast neutron physics, slow neutron spectroscopy, neutron scattering, magnetic properties of transition metals, ion doping techniques, and new measuring methods.
Transl. by G.G.

N72-25990# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).
AN INTRODUCTION TO DISCRETE EVENT SIMULATION
A. T. Boyd Mar. 1972 42 p refs
(ETN-5) Avail: NTIS HC $4.25

Discrete event simulation and the techniques are introduced. The functions of simulation are summarized, and the type or problem which can be studied using discrete event techniques is identified. The main characteristics of this form of simulation are then enumerated and illustrated by examples taken from a simulation of ship berthing operations. Some areas of caution are described, and the advantages and disadvantages of using program packages are outlined. ESRO

N72-25991# Research Analysis Corp., McLean, Va.
SELECTED MILITARY APPLICATIONS OF NONLINEAR PROGRAMMING
Arnold P. Jones, ed. Feb. 1972 79 p refs

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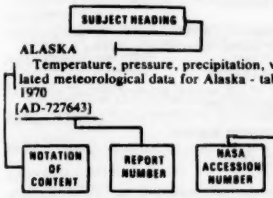
The paper presents a technical discussion of several military applications of nonlinear programming (NLP) that have been made by RAC during the past decade. The mathematical presentations included in the paper enable the reader, who has some general familiarity with NLP, to acquire some facility in NLP modeling. Author (GRA)

SUBJECT INDEX

TYPICAL SUBJECT INDEX LISTING



The subject heading is a key to the subject content of the document. The Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The NOC's are arranged under each subject heading in ascending accession number order.

A

ABERRATION
Holographic recording of hypersonic projectile in tunnels, including elliptical device and aberrations
[ISL-41/71] N72-25507

ABLATION
Ablative system with liquid carrying ablattive material bodies and forming self-replacing ablative surface
[NASA-CASE-LEW-10359] N72-25911

ABLATIVE MATERIALS
Ablative system with liquid carrying ablattive material bodies and forming self-replacing ablative surface
[NASA-CASE-LEW-10359] N72-25911

ABSORPTION SPECTRA
Infrared absorption properties of N2O from 760 to 2380/cm
[AD-737839] N72-25169
Absorption spectra of ground based passive microwave radiometric probing of atmosphere
N72-25371

ABSTRACTS
Abstracts on research along coastal zone and shallow water margins of continent
[AD-735486] N72-25402
Abstracts and indexes on plasma instabilities
[AD-738218] N72-25676

ABUNDANCE
Abundances in sun and solar wind and estimates of deuterium and helium 3 in protosolar gas
N72-25725
Rotation of deep solar interior based on observed oblateness, implied gravitational quadrupole moment, slow solar wind braking, and Li depletion and lack of Be depletion
N72-25812

ACCELERATED LIFE TESTS
Accelerated stress and life tests of thick film resistors
[AD-738269] N72-25274

ACCELERATION [PHYSICS]
Physiological tests of vestibulo-ocular reflex by counterroll to determine effects of positive acceleration on dynamics of vestibular system of rhesus monkeys
[AMRL-TR-71-59] N72-25040
Influence of tilts and accelerations affecting gravimeter
[AD-737110] N72-25399

ACCELERATION STRESSES [PHYSIOLOGY]
Physiological tests of vestibulo-ocular reflex by counterroll to determine effects of positive acceleration on dynamics of vestibular system of rhesus monkeys
[AMRL-TR-71-59] N72-25040

ACCELERATORS
Social, economic, and physical impact of high energy physics accelerator laboratory on environment
[WASH-1505] N72-25291

ACCELEROMETERS
Development of combined velocimeter and accelerometer based on color changes in liquid crystalline material subjected to shear stresses
[NASA-CASE-ERC-10292] N72-25410

ACCIDENT PREVENTION
Accident preventing functions of National Transportation Safety Board
N72-25958
Hazard prediction analysis for safety management in operation of rail transportation systems
N72-25983

ACOUSTIC EXCITATION
Performance tests of acoustic radar equipment to detect vortices formed by low flying aircraft and comparison with conventional sensing methods
[FAA-RD-71-103] N72-25008
Effects of random excitation on cavity pressure and panel vibrations
[NASA-CR-112051] N72-25623

ACOUSTIC MEASUREMENTS
Use of acoustic waves for remote probing of lower atmosphere
N72-25384
Vertical profiles of wind and temperature by remote acoustical sounding
N72-25386
Noise levels and spectral analysis for Vidraria Company in Sao Paulo, Brazil
[TR-7201.561] N72-25620
Acoustic survey of noise levels in Colegio Objetivo
[TR-7111.549] N72-25621
Noise level measurements, and octave band analysis for large maritime type diesel engine operating under full-load conditions
[TR-7202.564] N72-25622

ACOUSTIC VELOCITY
Acoustic velocity, lattice vibrations, and magnetic permeability of A15 phase in superconducting intermetallic compounds
N72-25686

ACOUSTICS
Mechanics, acoustics, ultrasonics, radio, and structural engineering research
N72-25626
Theoretical acoustics applied to jet engine noise generation, propagation, and reduction studies
N72-25632

ACTIVITY [BIOLOGY]
Proceedings of conference on animal orientation and navigation capabilities
[NASA-SP-262] N72-25062

ACTUATORS
Characteristics of lightweight actuator for imparting linear motion using elongated output shaft
[NASA-CASE-NPO-11222] N72-25456
Actuator with integrated motor and epicyclic gear reducer for space missions
N72-25765
Linear displacement actuator including switching circuit and laser interferometer gage
N72-25804

ADAPTERS
Flightweight components and water cooled test adapters for hypersonic engine
[NASA-CR-112055] N72-25711

ADAPTIVE CONTROL
Adaptive narrow band, frequency modulation, voice communication system
N72-25783

ADDRESSING
Address contractions of variables in ALGOL 60
[NPL-NAC-14] N72-25244

ADJOINTS
Generalization of Hamiltonian and bilinear functional for nonself-adjoint mechanical systems
[REPT-64] N72-25459

ADJUSTING
Electrical and mechanical adjustments of quantum magnetometers for geomagnetic component measurement
N72-25434

ADSORPTION
Numerical analysis of diffusion coefficients and characteristics of diffusion, adsorption, and reaction type processes
[DISS-4746] N72-25162

AERIAL RECONNAISSANCE
Infrared radiometer and video scan system for remote sensing of root rot disease in Pacific Northwest Douglas fir tree population
[NASA-CR-126719] N72-25029
Design and development of remote sensors for oceanographic experiments on marine biology and thermal pollution
[AD-737348] N72-25405

AERODYNAMIC BALANCE
Optimization technique, problem formulation, and results obtained in design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123644] N72-25843
Mathematical models used in application of modern optimal control techniques to design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123645] N72-25844

AERODYNAMIC CHARACTERISTICS
Aerodynamic characteristics of elliptical airfoil with circulation control by tangential trailing edge blowing
N72-24989
Analysis of techniques and computer programs for extracting stability derivative information from flight test records
[NASA-CR-2016] N72-24991
Development and application of computer program for predicting unsteady loads caused by trailing edge control surface motions at subsonic speed
[NASA-CR-2003] N72-24992
Application of state transition matrix for numerical analysis of stability and gust response of lifting rotor with rigid flapping blades and rigid hub
N72-25001

AERODYNAMIC COEFFICIENTS
Aerodynamic characteristics of elliptical airfoil with circulation control by tangential trailing edge blowing
N72-24989
Drag coefficients in falling sphere technique for atmospheric density sensing
[NASA-CR-126742] N72-24995
Review of work on external flow jet flaps noting lift coefficient
[ARC-CP-1194] N72-24998

AERODYNAMIC DRAG
Drag coefficients in falling sphere technique for atmospheric density sensing
[NASA-CR-126742] N72-24995

AERODYNAMIC LOADS
Development and application of computer program for predicting unsteady loads caused by trailing edge control surface motions at subsonic speed
[NASA-CR-2003] N72-24992

AEROLOGY
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for July 1971
N72-25578
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for Aug. 1971
N72-25579
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for Sept. 1971
N72-25580
Aerological data at Uccle [Belgium] over years 1966 to 1970
N72-25590

AERONAUTICAL ENGINEERING
Proceedings of conference on applications of laser technology for aerodynamic measurements
[AGARD-LS-49] N72-25493
Congressional hearings concerning aeronautical research
N72-25945

AERONAUTICS
Illustrated biography of Wiley Post to record significant accomplishments in long range flight and aeronautical engineering
N72-25952

AEROSOLS
Optical radar measurements of atmospheric aerosols
N72-25360
Using lidar to determine size and concentration of atmospheric aerosols
N72-25361

AEROSPACE ENVIRONMENTS
Aerospace environment requirements for spacecraft operations, including information on solar activity, geomagnetic field, radiation dosage, and star catalogs N72-25239
Instrument systems and experiments for forty spacecraft
[NASA-TM-X-2066] N72-25424
AEROSPACE INDUSTRY
Aerospace technology transfer to biomedical research problems, including transfer innovations and potential applications
[NASA-CR-126773] N72-25101
System safety assessment and current application in aerospace N72-25968
AEROSPACE MEDICINE
Proceedings of conference on medical aspects of spatial disorientation and effects on safe aircraft operation
[AGARD-CP-95-PT-1] N72-25031
Clinical evaluation and medical treatment of spatial disorientation problems in flying personnel N72-25047
FAA index on aviation medicine and aeromedical data reports
[FAA-AM-72-1] N72-25103
AEROSPACE SCIENCES
Proceedings of conference on applications of laser technology for aerodynamic measurements
[AGARD-LS-49] N72-25493
Appropriations hearings for housing and urban development, space science, and Veterans Administration N72-25932
Contributions of NASA programs to specific fields of technology - Vol. 2
[NASA-CR-126562] N72-25954
Research projects, applied science, and technical developments in East European scientific organizations and institutions
[JPRS-56106] N72-25959
AEROTHERMODYNAMICS
Apollo spacecraft models used to obtain flight test and wind tunnel data on aerothermodynamic measurements at superorbital velocities
[NASA-TN-D-6843] N72-25923
AGRICULTURE
Bibliography on use of remote sensing in forestry, agriculture, and plant ecology N72-25327
AIR
Radiative heat transfer effects behind reflected shock waves in air and nitrogen
[NASA-CR-126726] N72-25917
AIR FLOW
Orifice efficiencies for air flow into compartment from flowing external stream
[NASA-CR-61383] N72-25305
Large mass flow of high temperature air at hypersonic speeds
[NASA-CASE-LAR-10612-1] N72-25307
Application of laser beams for measurement of aerodynamic flow fields at supersonic and hypersonic speeds N72-25503
Development and characteristics of dual scatter laser Doppler velocimeter for flow distribution measurement in wind tunnels, helicopter downwash, and across high lift wing sections N72-25506
Airborne sound generated by splitter-type damper air flow, as function of air velocity
[RVO-A70/KM/116] N72-25633
AIR NAVIGATION
Concepts, philosophy, and development of minimum operational characteristics for airborne navigation systems
[DO-149] N72-25603
AIR POLLUTION
Actions of EPA for achieving 90 percent reduction of hydrocarbons in motor vehicle emissions by 1975 N72-25585
Annotated bibliography of documents on hydrochloric acid and air pollution
[AP-100] N72-25588
Analysis of emissions from aircraft piston and gas turbine engines - tables
[PB-207107] N72-25589
AIR PURIFICATION
Fabrication and operational procedures for processing lunar samples in sterile nitrogen atmosphere
[NASA-TN-D-6858] N72-25099
AIR TRAFFIC CONTROL
Performance tests of L band communication concepts for air traffic control equipment installed in Applications Technology Satellite-F
[NASA-TM-X-65906] N72-25601
AIR TRANSPORTATION
Senate report on transportation of Government civil and military passengers and cargo by civil and military air carriers
[S-REPT-92-503] N72-25948
AIR WATER INTERACTIONS
Sea-air energy flux measurements from atmospheric budget, surface layer vertical eddy flux, and upper ocean heat budget data
[NOAA-TM-ERL-BOMAP-9] N72-25333
AIRBORNE EQUIPMENT
Using airborne scanning infrared spectrometer for remote detection of CAT N72-25379
AIRBORNE/SPACEBORNE COMPUTERS
Onboard stored program computer for OAO C N72-25776
AIRCRAFT ACCIDENT INVESTIGATION
Practical application of mishap data in Army aircraft system safety programs N72-25967
AIRCRAFT ACCIDENTS
Analysis of US general aviation aircraft accidents for calendar year 1969 N72-25003
Review of U.S. general aviation accidents for 1969
[NTSB-ARG-71-1] N72-25004
Aircraft accident involving DC-9 charter flight on instrument landing approach to Huntington, West Virginia airport on 14 November, 1970
[NTSB-AAR-72-11] N72-25006
Aircraft accident report concerning DC-9 aircraft contact with ocean surface and subsequent emergency landing at Martha's Vineyard, Massachusetts, June 22, 1971
[PB-207101] N72-25013
Analysis of spatial disorientation occurrences among military pilots and classification according to types of aircraft and nature of accidents N72-25033
Analysis of military aircraft accidents caused by spatial disorientation N72-25034
Statistical analysis of military aircraft accidents to determine incidents caused by spatial disorientation N72-25035
Psychophysiological and environmental factors involved in aircraft accidents of military aircraft and effect of flying experience in reducing spatial disorientation N72-25036
AIRCRAFT COMMUNICATION
Communication support for Apollo by Apollo range instrumentation aircraft
[NASA-TM-X-68825] N72-25181
AIRCRAFT COMPARTMENTS
Development of standardized method for evaluating physical geometry of aircrew stations - Vol. I
[AD-738006] N72-25015
Computer programs for improved methods for evaluating physical compatibility of crew members with crew stations - Vol. 3
[AD-738007] N72-25016
Development of mathematical model for evaluating compatibility of flight crew personnel and aircraft crew stations - Vol. 4
[AD-738008] N72-25017
Validation of man-model joint movement parameters to determine compatibility of flight crews and aircraft compartments - Vol. 5
[AD-738009] N72-25018
AIRCRAFT CONFIGURATIONS
Validation of man-model joint movement parameters to determine compatibility of flight crews and aircraft compartments - Vol. 5
[AD-738009] N72-25018
AIRCRAFT CONTROL
Contribution of reduced visibility and turbulence to loss of aircraft control and inadvertent aircraft maneuvers N72-25041
Mathematical models for describing pilot performance during multiple input-output controller tasks
[NASA-CR-112048] N72-25128
Development of thrust control system for application to control of aircraft and spacecraft
[NASA-CASE-MSC-13397-1] N72-25595
AIRCRAFT ENGINES
Rotor head, rotor blade, transmission, and Rolls Royce 360 engine studies
[AD-737611] N72-25014
Flightweight components and water cooled test adapters for hypersonic engine
[NASA-CR-112055] N72-25711
Installation of structures assembly model and wind tunnel systems
[NASA-CR-112056] N72-25712
Aerothermodynamic integration model, including combustor design, flow distribution, and heat transfer problems
[NASA-CR-112058] N72-25713
Aerothermodynamic integration model, including flow paths, leading edges, and ducts
[NASA-CR-112059] N72-25714
Purge system and components of HRE AIM
[NASA-CR-112060] N72-25715
AIRCRAFT EQUIPMENT
Low pass filter requirements and performance in variable speed constant frequency system for aircraft electric power supplies
[RAE-TR-71088] N72-25273
Concepts, philosophy, and development of minimum operational characteristics for airborne navigation systems
[DO-149] N72-25603
AIRCRAFT GUIDANCE
Concepts, philosophy, and development of minimum operational characteristics for airborne navigation systems
[DO-149] N72-25603
Performance and problems of microwave guidance systems for aircraft approach and landing
[RAE-TR-71186] N72-25606
AIRCRAFT HAZARDS
Analysis of US general aviation aircraft accidents for calendar year 1969 N72-25003
AIRCRAFT INSTRUMENTS
Summary of literature on altimeter display relating to aircraft height
[FAA-RD-72-46] N72-25426
Approximate compensation in airborne magnetometry for changing inductive field of aircraft moving through varying geomagnetic field N72-25435
AIRCRAFT LAUNCHING DEVICES
Human centrifuge tests to determine aircraft pilot disorientation during aircraft catapult launchings N72-25037
AIRCRAFT MODELS
Experimental method for measuring heat transfer in hypersonic aerodynamic models
[REPT-32] N72-25918
AIRCRAFT PERFORMANCE
Statistical analysis of mission profiles for passenger- and cargo-transport aircrafts
[TB-88] N72-25002
Improved aircraft ground performance in slush and wet runway conditions by addition of extra nose wheel
[ARC-CP-1206] N72-25009
Fixed base simulator study of direct lift control on VC-10 aircraft
[ARC-CP-1199] N72-25010
AIRCRAFT PILOTS
Human centrifuge tests to determine aircraft pilot disorientation during aircraft catapult launchings N72-25037
Analysis of aircraft pilot reports on occurrence of unreality and detachment during flight and relationship to spatial disorientation N72-25042
Illustrated biography of Wiley Post to record significant accomplishments in long range flight and aeronautical engineering N72-25952
AIRCRAFT PRODUCTION
Air safety program for aircraft manufacturers N72-25974
AIRCRAFT SAFETY
Fatigue assessment of safe life and fail-safe structures
[ARL/SM-REPT-334] N72-25899
Practical application of mishap data in Army aircraft system safety programs N72-25967
Pilot safety considerations in design and operation of X-24A lifting body vehicle N72-25969
AIRCRAFT SPECIFICATIONS
Air safety program for aircraft manufacturers N72-25974
AIRCRAFT STRUCTURES
Fatigue assessment of safe life and fail-safe structures
[ARL/SM-REPT-334] N72-25899
AIRFOILS
Aerodynamic characteristics of elliptical airfoil with circulation control by tangential trailing edge blowing N72-24989
Subsonic behavior of three annular airfoils for turbofan engine cowlings
[ARC-R/M-3688] N72-24999
AIRFRAME MATERIALS
Thermal aspects of using filamentary composite materials for airframes on atmospheric entry spacecraft
[SD-72-SH-0015] N72-25542
AIRLINE OPERATIONS
Improved aircraft ground performance in slush and wet runway conditions by addition of extra nose wheel
[ARC-CP-1206] N72-25009
ALCOHOLS
Effects of alcohol on problem solving tasks and vestibular stimulation
[FAA-AM-72-11] N72-25108
ALGEBRA
Principles of theory of categories with models and coalgebraic functions
[DISS-4670] N72-25572

ALGOL
Address contractions of variables in ALGOL 60
[NPL-NAC-14] N72-25244
ALGORITHMS
Contouring algorithms over triangular meshes for contour map making
[NPL-NAC-10] N72-25245
Inversion algorithm for satellite radiometric observations
N72-25376
Algorithm for calculating eigenvalues in quotient-difference transformation of tridiagonal matrix
[DISS-4624] N72-25568
Numerical algorithm for determining optimal plane changes of three impulse transfers between non-coplanar circular orbits
[NASA-TM-X-64662] N72-25809
ALKALI HALIDES
Critical shear stress of alkali halides containing non-agglomerated and agglomerated elastic dipoles
[NRC-TT-1544] N72-25166
ALKANES
Methods for predicting B-12 values for binary gas mixtures containing alkanes
[NPL-DCS-14] N72-25167
ALLOYS
Mechanical behavior of alloys and metals during high temperature deformation
[REPT-108] N72-25681
ALPHA PARTICLES
Radiation damage in natural zircon caused by alpha particle recoil of parent uranium nucleus
[ORO-4049-2] N72-25659
ALTERNATING CURRENT
Dc to ac to dc converter with transistor driven synchronous rectifiers
[NASA-CASE-GSC-11126-1] N72-25253
ALTIMETERS
Summary of literature on altimeter display relating to aircraft height
[FAA-RD-72-46] N72-25426
ALUMINUM
Ultrasonic signal counting technique for flaw detection in aluminum welds
[NASA-CR-123649] N72-25464
Damage to thermal aluminum coating caused by short wavelength ultraviolet radiation
N72-25769
ALUMINUM ALLOYS
Metallurgical evaluations of strength in TIG welded metal filled aluminum alloy 2219-T87
[NASA-TM-X-64659] N72-25474
Microstructure of superplastic micrograin aluminum bronze
[REPT-93] N72-25514
Creep, tensile and thermal properties, and microstructure of Zn-Al alloys
[BM-RI-7538] N72-25518
Influence of cracks on tensile strength of steel test bar and on strength and plasticity of aluminum alloys
N72-25530
ALUMINUM CHLORIDES
Anodic and cathodic passivation of aluminum electrode in AlCl3-KCl-NaCl melts between 100 and 160 C
[NASA-CR-126727] N72-25153
ALUMINUM COMPOUNDS
Spectroscopic analysis of vibration spectra and spectral reflectance in AlO3La, AlO3Pr, and AlO3Nd
N72-25685
ALUMINUM OXIDES
Near ultraviolet spectra and Zeeman effects of iron and titanium containing corundum crystals
[DISS-4600] N72-25689
AMPHIBIA
Homing behavior of salamanders subjected to sensory impairment and manipulative techniques
N72-25092
AMPLIFICATION
Absolute antenna gain measurement using signal emitted from radio star
N72-25793
Two-element antenna array to measure gain improvement for spacecraft tracking
N72-25796
AMPLITUDE MODULATION
Amplitude limiters and trigger switches with biased diodes for threshold stabilization of alternating voltage
N72-25265
ANALOG COMPUTERS
Dampometer for measuring amount of damping in wind tunnel test model
[NASA-CR-123671] N72-25289
ANALOG DATA
Analog signal to discrete time converter
[NASA-CASE-ERC-10048] N72-25251
ANALYSIS OF VARIANCE
Thermal finite element computer program for variance analysis on predicted temperature field
N72-25764
ANALYTIC FUNCTIONS
Analytical and empirical procedures for pre-emphasis determination of S band constant bandwidth FM/FM station
[NASA-TM-X-64648] N72-25182
Riemann functions and conformal mapping for construction of complex systems
[DISS-4707] N72-25565
ANATOMY
Anatomical function of spermaceti organ in sperm whales
[CONTRIB-74] N72-25087
ANGULAR RESOLUTION
Accuracy and resolution in determining angular target coordinates by radar stations
N72-25196
ANIMALS
Sensory and motor psychology studies with trained animals
N72-25081
Nocturnal orientation by amphipods using moonlight
N72-25095
Effects of toxic methyl isobutyl ketone vapor on physiological processes in dogs, monkeys, and rats during 90 day continuous exposure
[NASA-CR-126744] N72-25102
ANNUAL VARIATIONS
Annual variations of upper atmospheric sodium abundance based on dust particle temperature
N72-25396
ANTENNA ARRAYS
Four element antenna array as ground support for superhigh frequency downlink from satellite
N72-25772
Two-element antenna array to measure gain improvement for spacecraft tracking
N72-25796
ANTENNA FEEDS
Spherical wave expansion method for synthesizing fields of feed for spherical reflector
N72-25177
ANTENNA RADIATION PATTERNS
Spherical wave expansion method for synthesizing fields of feed for spherical reflector
N72-25177
Development of control for wide band dipole antenna with high directivity of shaped radiation pattern
[PB-206688] N72-25205
ANTENNAS
Design and performance of real time computerized control system for large antenna
[NASA-CR-122417] N72-25194
Absolute antenna gain measurement using signal emitted from radio star
N72-25793
ANTHROPOMETRY
Anthropometry and medical re-evaluation of pilots
N72-25055
APOLLO PROJECT
Specific aspects of Apollo health and quarantine programs considered for potential application to broad program required for protection of life and health of US astronauts in future manned space flight
[NASA-TN-D-6856] N72-25100
Communication support for Apollo by Apollo range instrumentation aircraft
[NASA-TM-X-68825] N72-25181
Apollo VHF ranging system development program
[NASA-TN-D-6851] N72-25187
Real time auxiliary computing facility for carrying out mission support and simulation programs during Apollo project
[NASA-TN-D-6855] N72-25223
Apollo mission planning for lunar module descent and ascent based on postflight analysis of previous missions
[NASA-TN-D-6846] N72-25855
Analysis of spacecraft docking systems as designed and utilized in Apollo project
[NASA-TN-D-6854] N72-25857
APOLLO SPACECRAFT
Flight tests of Apollo spacecraft communications systems
[NASA-TN-D-6852] N72-25186
Design development and acceptance checkout testing programs for Apollo spacecraft
[NASA-TN-D-6857] N72-25475
Analysis of Apollo spacecraft systems of thermal protection from engine-plume environments for application to future spacecraft programs
[NASA-TN-D-6844] N72-25922
Apollo spacecraft models used to obtain flight test and wind tunnel data on aerothermodynamic measurements at superorbital velocities
[NASA-TN-D-6843] N72-25923
APOLLO 9 FLIGHT
Analysis of thermophysical properties of thermal control coatings used on Apollo 9 flight
[NASA-TN-D-6863] N72-25864
APOLLO 15 FLIGHT
Postflight analysis of EVCS to LM communications link for Apollo 15 mission to verify performance prediction techniques
[NASA-TM-X-68426] N72-25183
Failure of parachute on Apollo 15 spacecraft during earth landing
[NASA-TM-X-68350] N72-25848
APOLLO 16 FLIGHT
Astronauts report to House Committee on Apollo 16 flight, EVAs, lunar and earth photographs, and scientific experiments
N72-25835
Calibration curves for Apollo 16 command service module pulse code modulation downlink and onboard display
[NASA-TM-X-68322] N72-25830
APPLICATIONS OF MATHEMATICS
Numerical analysis of torsion decomposition of finite CW-Complexes
[DISS-4460] N72-25567
APPROACH CONTROL
Performance and problems of microwave guidance systems for aircraft approach and landing
[RAE-TR-71186] N72-25606
APPROPRIATIONS
Appropriations hearings for housing and urban development, space science, and Veterans Administration
N72-25932
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 1
N72-25936
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 2
N72-25937
Hearings concerning FY 72 transportation appropriations
N72-25946
Federal funds for research and development for FY 1970, 71, and 72
[NSF-71-35-VOL-20] N72-25956
APPROXIMATION
Approximation of N[h] profile by exponential functions for D region
N72-25389
ARC DISCHARGES
High frequency arc discharges and pulse generation for ultrasonic tests
[NASA-CASE-MFS-21233-1] N72-25627
ARIEL SATELLITES
Ground data processing requirements for Ariel satellites
N72-25242
ARMED FORCES
Laws governing military use of civil aircraft
N72-25960
ARMED FORCES [UNITED STATES]
Hearings before House Committee on budget requests for military construction and family housing
N72-25943
Hearings before House Committee on budget requests for Army, Safeguard, and Defense Agencies construction
N72-25944
Practical application of mishap data in Army aircraft system safety programs
N72-25967
AROMATIC COMPOUNDS
Organic structure of aromatic compounds after photoionic and photosensitive dissociation
N72-25156
ARTHROPODS
Physiological and biological mechanisms responsible for anemomenotactic orientation in beetles and scorpions
N72-25093
ARTIFICIAL SATELLITES
Application of Doppler effect and artificial satellite coverage for tracking wild animals
N72-25063
Electronic equipment and techniques for using satellite systems to track animals to determine migratory and navigation behavior
N72-25068
Transmission, recording, and processing of data telemetered from WRESAT satellite
[WRE-TN-516-[T]] N72-25195
Development of experiments for testing inertial instruments in drag-free satellite
[AD-738309] N72-25608
ASIA
Computation of gravimetric Eurasia, North Atlantic, and United States geoid from satellite and surface gravity derived data
[NASA-TM-X-65884] N72-25344
Coastal marine meteorological parameters for southwestern Asia
[AD-737909] N72-25592
ASTEROIDS
Astronomical observations of asteroids
[NASA-SP-267] N72-25753
ASTRONAUTS
Three transceiver lunar emergency system to relay voice communication of astronaut
[NASA-CASE-MFS-21042] N72-25171
ASTRONOMICAL CATALOGS
Aerospace environment requirements for spacecraft operations, including information on solar activity, geomagnetic field, radiation dosage, and star catalogs
N72-25239

ASTRONOMICAL PHOTOGRAPHY
Photometric and photographic data used to identify new faint blue stars and study longitudinal distributions of interstellar absorption, H I, and H II across Carina spiral feature
N72-25736

ASTRONOMICAL SPECTROSCOPY
Equivalent widths of line spectra for late F dwarfs
[BULL-167] N72-25745
Comparison of continuum radiation and spectral line radiation in W3 and W51 regions
[RR-96] N72-25748
Table of multiplet wavelengths and finding list of lines, for astrophysicists
[NSRDS-NBS-40] N72-25807

ASTRONOMY
FORTRAN programs for astronomy
[RR-102] N72-25220
Astronomical observations of asteroids
[NASA-SP-267] N72-25753
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 15 May 1972
[JPRS-55985] N72-25824
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 1 June 1972
[JPRS-56154] N72-25834

ASTROPHYSICS
Table of multiplet wavelengths and finding list of lines, for astrophysicists
[NSRDS-NBS-40] N72-25807

ATMOSPHERIC ATTENUATION
Atmospheric absorption measurements for meteorological research using microwave transmissions from satellite beacons
N72-25351
ATS 5 millimeter wave propagation measurements for determining atmospheric attenuation of earth-space links
N72-25778

ATMOSPHERIC BOUNDARY LAYER
Atmospheric circulation model with stationary planetary boundary layers
N72-25575

ATMOSPHERIC CHEMISTRY
Equipment and polyhydric chemicals for dispersing fog - Foggy Cloud 4 Project
[TOPR-178-1-121] N72-25154

ATMOSPHERIC CIRCULATION
Atmospheric circulation model with stationary planetary boundary layers
N72-25575

ATMOSPHERIC COMPOSITION
Design and development of two types of atmosphere sampling chambers
[NASA-CASE-NPO-11373] N72-25323
High altitude balloon flights to measure SO2 and NO2 gases in earth atmosphere using absorption spectroscopy
[NASA-CR-115639] N72-25343
Conference papers dealing with remote probe techniques for observing and measuring physical composition and dynamical structure of atmosphere
[NASA-CR-126787] N72-25347
Optical radar measurements of atmospheric aerosols
N72-25360
Using lidar to determine size and concentration of atmospheric aerosols
N72-25361
Composition, thermal structure, density, and unusual characteristics of planetary lower atmospheres, emphasizing Mars, Venus, and Jupiter atmospheres
N72-25816
Atmospheric compositions of planets, satellites, and comets
N72-25817
Present and past compositions and evolution of Earth, Venus, Mars, and Jupiter atmospheres
N72-25822

ATMOSPHERIC DENSITY
Drag coefficients in falling sphere technique for atmospheric density sensing
[NASA-CR-126742] N72-24995
Effects of atmospheric pressure, density, temperature, and wind variations on spacecraft stability, control, and heating
[NASA-CR-2062] N72-25336
Global models of temperature, air density, and pressure in lower thermosphere
[AD-738330] N72-25403
Composition, thermal structure, density, and unusual characteristics of planetary lower atmospheres, emphasizing Mars, Venus, and Jupiter atmospheres
N72-25816

ATMOSPHERIC ENTRY
Design and development of isotope heat source to meet requirements of steady-state operation and atmospheric entry
[NASA-TN-D-6833] N72-24994
Analysis of spacecraft motions and radio frequency blackout during atmospheric entry
[NASA-TM-X-2562] N72-25865

ATMOSPHERIC MODELS
Feasibility of line-of-sight microwave propagation experiments in analyzing significant meteorological problems
N72-25348
Line-of-sight methodology used with microwave propagation in remote atmospheric probing
N72-25350
Incoherent and coherent CW laser systems for remote atmospheric probing
N72-25355
Global models of temperature, air density, and pressure in lower thermosphere
[AD-738330] N72-25403
Atmospheric circulation model with stationary planetary boundary layers
N72-25575

ATMOSPHERIC PHYSICS
Conference papers dealing with remote probe techniques for observing and measuring physical composition and dynamical structure of atmosphere
[NASA-CR-126787] N72-25347

ATMOSPHERIC PRESSURE
Effects of atmospheric pressure, density, temperature, and wind variations on spacecraft stability, control, and heating
[NASA-CR-2062] N72-25336
Results and future trends of laboratory microbarograph system
[REPT-327] N72-25388
Global models of temperature, air density, and pressure in lower thermosphere
[AD-738330] N72-25403

ATMOSPHERIC SCATTERING
Optical radar observations above 30 km
N72-25359
Scattering mechanism of radar echoes from clear air
N72-25362
Meteorological value of ultrasensitive radar
N72-25363

ATMOSPHERIC TEMPERATURE
Effects of atmospheric pressure, density, temperature, and wind variations on spacecraft stability, control, and heating
[NASA-CR-2062] N72-25336
Global models of temperature, air density, and pressure in lower thermosphere
[AD-738330] N72-25403
Statistical method for objectively producing forecasts of daily maximum temperatures from numerical model output
[NOAA-TM-NWS-TDL-45] N72-25581
Composition, thermal structure, density, and unusual characteristics of planetary lower atmospheres, emphasizing Mars, Venus, and Jupiter atmospheres
N72-25816
Line shape and band structure effects on radiative equilibrium temperature profile in planetary atmospheres and method for treating nongrey radiative transfer problems
[NASA-TM-X-6509] N72-25827

ATMOSPHERIC TURBULENCE
Remote probing of optical strength of atmospheric turbulence and of wind velocity at various altitudes by measuring spatial and temporal covariance of scintillation
N72-25356
Signal scattering by turbulent irregularities
N72-25369
Remote measurement of winds and atmospheric turbulence by cross-correlation of passive optical signals
N72-25380
Field test evaluation of optical cross beam system for measuring convective wind velocities
N72-25382

ATMOSPHERICS
Observation methods and properties of sferics including meteorological implications
N72-25383

ATOMIC CLOCKS
Proposed NASA experiment for spaceborne clock system to develop new atomic frequency standards technology and improve international time and frequency comparisons
[NASA-CR-122394] N72-25423

ATOMIC ENERGY LEVELS
Principles of laser operation to include materials, resonant cavity construction, and theory of atomic energy levels
N72-25494
Hartree-Fock identification of Kappa alpha satellites in light atoms
[CNRS-AO-4091] N72-25643

ATOMIC SPECTRA
Q operator formalism for determining D autoionization states of atomic He and ionic H
[NASA-TM-X-65898] N72-25647
Table of multiplet wavelengths and finding list of lines, for astrophysicists
[NSRDS-NBS-40] N72-25807
Research on molecular beams, microwave spectroscopy, atomic resonance and scattering
[AD-737814] N72-25840

ATOMS
Hartree-Fock identification of Kappa alpha satellites in light atoms
[CNRS-AO-4091] N72-25643

ATS 5
ATS 5 millimeter wave propagation measurements for determining atmospheric attenuation of earth-space links
N72-25778

ATS 6
Performance tests of L band communication concepts for air traffic control equipment installed in Applications Technology Satellite-F
[NASA-TM-X-65906] N72-25601

ATTENTION
Effect of auditory distraction on Stroop color-word interference performance tests
[FAA-AM-72-14] N72-25132

ATTITUDE [INCLINATION]
Influence of tilts and accelerations affecting gravimeter
[AD-737110] N72-25399

ATTITUDE CONTROL
Effects of mass product of inertia and rotor constraints on attitude stability of dual spin spacecraft
N72-25594

ATTITUDE STABILITY
Orbital stability of Radio Astronomy Explorer satellite having four antenna booms
N72-25759

AUDIOMETRY
Effects of sonar headset echo ranging on hearing effects in sonar technicians
[AD-737207] N72-25113

AUDITORY DEFECTS
Effects of sonar headset echo ranging on hearing effects in sonar technicians
[AD-737207] N72-25113

AUDITORY PERCEPTION
Effect of middle ear muscle contractions on hearing and echo processing in Mustache Bat
N72-25084

AUDITORY STIMULI
Effects of specialized auditory stimuli on human performance of spatial orientation tasks
[AD-737351] N72-25112
Effect of auditory distraction on Stroop color-word interference performance tests
[FAA-AM-72-14] N72-25132

AURORAL ECHOES
HF backscatter system for collecting auroral clutter data
[AD-738305] N72-25203

AURORAL ZONES
Measurement of currents associated with quiet auroral arc using vector magnetometer and lunar aspect sensor
N72-25324
Measurement of electric fields, magnetic fields, and charged particles in auroral band using Nike-Tomahawk rocket vehicle
N72-25326

AURORAS
Solar physics, planetary atmospheres, comets, and earth aurora and upper atmosphere, studied with satellite, rocket, and space probe data
N72-25805

AUSTENITE
Effect of grain boundary increase and intragrain defects in austenite structure on carbon diffusion
[NASA-TT-F-14272] N72-25516
Effects of production methods on residual stresses in austenite plated steel sheets
N72-25526
Corrosion resistance of cold worked austenitic CrNi steels and Ni alloys in superheated steam
[EURFNR-954] N72-25534

AUSTENITIC STAINLESS STEELS
Electron microscopic examination of dislocation structure in alternately stressed austenitic steels
[NASA-TT-F-14267] N72-25521

AUTOIONIZATION
Q operator formalism for determining D autoionization states of atomic He and ionic H
[NASA-TM-X-65898] N72-25647

AUTOMATA THEORY
Mathematic modeling, automata theory, speech synthesis, and mechanical model of heart and lungs
[JPRS-56072] N72-25135
Automata functioning in stationary random media with restricted length of input word and minimization of losses
N72-25138

AUTOMATIC CONTROL
Automatic analysis of ECG at rest, during and after exercise with two computer systems
N72-25052
Automatic temperature control for liquid cooled space suit
[NASA-CASE-ARC-10599-1] N72-25129

Design and performance of real time computerized control system for large antenna
[NASA-CR-122417] N72-25194
Automatic and manual checkout equipment for testing space vehicle signal transmission lines
[NASA-CASE-KSC-10385] N72-25211
Computer programming for regulation of switchgear demands
N72-25226
Speed control system for dc motor equipped with brushless Hall effect device
[NASA-CASE-MFS-20207-1] N72-25267
Nonlinear oscillations in automatic control systems
[AD-738124] N72-25574
Digital computer technique for servo and control systems of large antennas
N72-25794

AUTOMATIC CONTROL VALVES
Solar cell activated silver zinc battery for interplanetary flight
N72-25767

AUTOMATIC LANDING CONTROL
Automatic flare and decrab guidance and control system for space shuttles
[NASA-CR-114436] N72-25599

AUTOMOBILES
Systems analysis for safety design of automobiles and highways
N72-25984

AUXILIARY POWER SOURCES
APU for providing hydraulic and electric power to space shuttle booster and orbiter
[NASA-CR-1994] N72-25024

AVERAGE
Convergence theorems in averaging theory
[TN-34] N72-25571

AXIAL COMPRESSION LOADS
Development and characteristics of device for indicating and recording magnitude of force applied in axial direction
[NASA-CASE-MSC-15626-1] N72-25411

AXIAL FLOW TURBINES
Calculation of annulus wall turbulent boundary layers in axial flow turbines noting flow deflections of blades
[ARC-CP-1196] N72-25314

AXIAL LOADS
Effects of axisymmetric imperfections on buckling of axially loaded cylindrical shells
[REPT-80] N72-25889

AXIOMS
Axiomatic designations of logic differential equations used in modeling dynamic systems
N72-25137

B

B STARS
Photometric and photographic data used to identify new faint blue stars and study longitudinal distributions of interstellar absorption, H I, and H II across Carina spiral feature
N72-25736

BACKGROUND NOISE
Comparison of infrasonic background noise with atmospheric jet streams
[KGO-724] N72-25392

BACKSCATTERING
Hypersonic spherical source flow with rarefied background, using Boltzmann equation
[RE-427J] N72-25304

BACTERIA
Portable tester for monitoring bacterial contamination by adenosine triphosphate light reaction
[NASA-CASE-GSC-10879-1] N72-25413
Bacteria detection of urine using bioluminescent reaction of ATP with luciferin and luciferase
N72-25800

BALLOON FLIGHT
High altitude balloon flights to measure SO2 and NO2 gases in earth atmosphere using absorption spectroscopy
[NASA-CR-115639] N72-25343

BALLOON SOUNDING
Vertical distribution of stratospheric methane by balloon-borne infrared spectrometers
[AERONOMICA-ACTA-A-97-1972] N72-25837

BARIUM
Barium cloud tracking and floating potential measurement for magnetospheric electric fields
[NASA-TM-X-65895] N72-25829

BARRIERS
Short range obstacle detector for surface vehicles using laser diode array
[NASA-CASE-NPO-11856-1] N72-25490

BASE PRESSURE
Measurement of base pressure fluctuations at subsonic and supersonic speeds on flared bodies with flat or hemispherical noses
[ARC-CP-1204] N72-24997

BATS
Neurophysiological analysis of echolocation and signal processing in bats
N72-25083
Effect of middle ear muscle contractions on hearing and echo processing in Mustache Bat
N72-25084
Olfactory stimuli and ultrasonic signal methods for individual recognition between mother and infant brown bats
N72-25085

BEACONS
Man-portable laser beacon and receiver system for land survey
N72-25802

BEARINGS
Measuring device for bearing preload using spring washers
[NASA-CASE-MFS-20434] N72-25288

BEES
Magnetoreception and orientation in dancing bees
N72-25096

BEETLES
Physiological and biological mechanisms responsible for anemomenotactic orientation in beetles and scorpions
N72-25093

BELGIUM
Aerological data at Uccle [Belgium] over years 1966 to 1970
N72-25590

BENDING
Static bending tests and brittleness of medium alloy steel
N72-25529
Iterative plate solution for flat shells in bending mode
[REPT-67] N72-25887

BERYLLIUM
Electrochemical machining of beryllium
[AD-738271] N72-25483

BEVATRON
Adaptation of Philips pulsed heavy gage ion source to bevatron
[LBL-304] N72-25613

BIBLIOGRAPHIES
Bibliography of 240 reactions in C-O-S and H-N-O-S systems
[NBS-SP-362] N72-25160
Bibliography on use of remote sensing in forestry, agriculture, and plant ecology
N72-25327
Annotated bibliography of references to published and unpublished items of geologic literature
[AD-735775] N72-25407
Bibliographic survey of series emittance thermal control coatings including materials properties and resistance to radiation
[ONERA-DERTS-NT-03-8] N72-25554
Annotated bibliography of documents on hydrochloric acid and air pollution
[AP-100] N72-25588

BILLETS
Ultrasonic tests of cast brass billets
[REPT-7110.541] N72-25466

BIMETALS
Application of spiral, bimetallic strip to create circular motion on mechanical shaft by changing strip temperature
[NASA-CASE-NPO-11283] N72-25260

BINARY CODES
Binary coded sequential acquisition ranging system for distance measurements
[NASA-CASE-NPO-11194] N72-25209

BINARY MIXTURES
Methods for predicting B-12 values for binary gas mixtures containing alkanes
[NPL-DCS-14] N72-25167
Phase stability of bond type metallic binary systems
[NPL-DCS-15] N72-25697

BIOASSAY
Method and criterion for evaluating ELF magnetic field interference effects on cardiac pacemaker function
[AD-737237] N72-25111
Bioassay of flavin coenzymes
[NASA-CASE-GSC-10565-1] N72-25149

BIOASTRONAUTICS
Specific aspects of Apollo health and quarantine programs considered for potential application to broad program required for protection of life and health of US astronauts in future manned space flight
[NASA-TN-D-6836] N72-25100

BIOCONTROL SYSTEMS
Physiological and biological mechanisms responsible for anemomenotactic orientation in beetles and scorpions
N72-25093

BIODYNAMICS
Proceedings of conference on animal orientation and navigation capabilities
[NASA-SP-262] N72-25062
Characteristics of biological telemetry systems and application in various areas of investigation with criteria for evaluation of systems
[JPRS-55354] N72-25189

BIOELECTRIC POTENTIAL
Manufacturing process for making prespiration resistant-stress resistant biopotential electrode
[NASA-CASE-MSC-90153-2] N72-25120

BIOENGINEERING
Characteristics of biological telemetry systems and application in various areas of investigation with criteria for evaluation of systems
[JPRS-55354] N72-25189

BIOGRAPHY
Illustrated biography of Wiley Post to record significant accomplishments in long range flight and aeronautical engineering
N72-25952

BIOINSTRUMENTATION
Electronic equipment and systems used to track wild animals in order to determine migratory and navigational behavior
N72-25067
Electronic equipment and techniques for using satellite systems to track animals to determine migratory and navigation behavior
N72-25068
Development of miniature electronic transmitters and application for monitoring biological and physiological activities
[NASA-CR-127047] N72-25191

BIOLOGICAL EFFECTS
Research on biological effects of radioisotope inhalation
[LF-44] N72-25109

BIOLUMINESCENCE
Bacteria detection of urine using bioluminescent reaction of ATP with luciferin and luciferase
N72-25800

BIOMEDICAL DATA
Proceedings of conference on medical aspects of spatial disorientation and effects on safe aircraft operation
[AGARD-CP-95-PT-1] N72-25031
Factors contributing to attrition from active airman status, particularly biological and medical characteristics
[FAA-AM-72-13] N72-25104
Development of miniature electronic transmitters and application for monitoring biological and physiological activities
[NASA-CR-127047] N72-25191

BIONICS
Operational characteristics of dolphin hydrolocator system
N72-25107

BIOTELEMETRY
Proceedings of conference on animal orientation and navigation capabilities
[NASA-SP-262] N72-25062
Pulse modulated biotelemetry system for determining energy budgets in free-ranging vertebrates from heart rate and body temperature measurement
N72-25123
Characteristics of biological telemetry systems and application in various areas of investigation with criteria for evaluation of systems
[JPRS-55354] N72-25189

BIRDS
Development and application of radio telemetry equipment for tracking migration of birds
N72-25065
Application of tracking radar for determining flight paths of migratory birds
N72-25069
Radar and visual tracking of migratory birds to determine correlation of flight altitude and wind direction on direction of migration
N72-25070
Radar observations of passerine birds to determine effects of wind and meteorological parameters on migratory behavior
N72-25071
Radar observations of migratory birds to determine effects of weather conditions on migration behavior
N72-25072
Radar observations of birds migrating in opaque cloud cover to determine effects of wind and meteorological conditions
N72-25073
Orientation of nocturnally migrating birds based on reference to stellar positions and sky rotation
N72-25074
Analysis of pattern recognition capability of migratory birds and manner of orientation with stellar presentations
N72-25075
Analysis of cues used by migratory birds for navigation and orientation
N72-25076
Effects of clock shift on orientation of migratory birds and deviations in initial orientation produced by varying amounts of clock shift
N72-25078

Environmental and endogenous timing factors as stimuli for bird migration
N72-25082
Use of magnetic cues to select migratory direction by European robins
N72-25097
BISTATIC REFLECTIVITY
Using lidar to determine size and concentration of atmospheric aerosols
N72-25361
BITS
Performance of convolution coding concatenated with MFSK modulation in Gaussian channel
[NASA-TM-X-65905] N72-25190
MOD 2 sequential function generator for multibit sequence, with two-bit shift register for each pair of bits
[NASA-CASE-NPO-10636] N72-25210
BLACK BRANT 4 SOUNDING ROCKET
Electronic systems of multiwire proportional counter to measure extra-solar X ray fluxes during Black Brant 4 flight
[NASA-CR-115509] N72-25743
BLACK SEA
Gravimetric surveys of Black Sea
[AD-737108] N72-25400
BLACKOUT [PROPAGATION]
Analysis of spacecraft motions and radio frequency blackout during atmospheric entry
[NASA-TM-X-2562] N72-25865
BLOOD PRESSURE
Raised arterial blood pressure levels in aircrew members
N72-25054
BODY TEMPERATURE
Pulse modulated biotelemetry system for determining energy budgets in free-ranging vertebrates from heart rate and body temperature measurement
N72-25123
BOLTZMANN TRANSPORT EQUATION
Hypersonic spherical source flow with rarefied background, using Boltzmann equation
[RE-427J] N72-25304
Proving of Boltzmann limit conjecture for two- and three-dimensional Lorentz gas with hard core molecular collisions
[NOTA-INTERNA-358] N72-25638
BOOMS [EQUIPMENT]
Design and characteristics of mechanically extended and telescoping boom on crane assembly
[NASA-CASE-NPO-11118] N72-25021
Thermal distortion and static bending plus twist measurements on deployable boom structures for spacecraft
N72-25789
BOOSTER ROCKET ENGINES
Overview of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123664] N72-25705
Summary of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123667] N72-25706
Planning documentation associated with feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123666] N72-25707
Final cost estimates for engine configurations and schedules selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123673] N72-25708
Design data book for engine system and subsystems selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123674] N72-25709
BORON
Origin of satellite/resonance lines of boron, carbon, and nitrogen ions
[NASA-TM-X-68338] N72-25649
BOUNDARY LAYER TRANSITION
Effect of disturbances produced by vibrating ribbon on accelerated laminar boundary layer at low Reynolds numbers
[AD-738335] N72-25321
BOUNDARY LAYERS
Integral method extended to viscous interaction phenomena over continuous range of wall cooling ratio
[IC-AERO-72-03] N72-25311
BOUNDARY VALUE PROBLEMS
Piecewise cross correlation technique for analyzing outputs of remote detection devices to eliminate noise from optical background fluctuations
N72-25381
Hybrid Galerkin equation derivation for nonself-adjoint boundary value problem
[REPT-82] N72-25556
BRASSES
Ultrasonic tests of cast brass billets
[REPT-7110.541] N72-25466
Deformation and fracture of fine-grained alpha-beta brass
[REPT-92] N72-25515
BREADBOARD MODELS
Breadboard tests of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements
[NASA-CR-126722] N72-25335
BREMSSTRAHLUNG
Bremsstrahlung X rays, optical diagnostics, and microwave calculations
[COO-1695-39] N72-25671
BRITTLENESS
Brittle fracture and cracks in steels, joints, and metal sheets
[JPRS-56070] N72-25527
Brittle fracture analysis of medium alloy steels for electroslag welded ship components
N72-25528
Static bending tests and brittleness of medium alloy steel
N72-25529
Tendency toward brittleness in low alloy steels
N72-25531
BRONZES
Instruments and procedures for ultrasonic inspection of cast bronze bars
[REPT-7009.453] N72-25467
Microstructure of superplastic micrograin aluminum bronze
[REPT-93] N72-25514
BUBBLES
Flow behavior of drops or bubbles moving in quiescent liquid under influence of gravitational force
N72-25297
BUCKLING
Effects of axisymmetric imperfections on buckling of axially loaded cylindrical shells
[REPT-80] N72-25889
BUDGETS
Congressional hearings on 1973 budget request by NASA
N72-25939
BUFFER STORAGE
Digital to analog converter with parallel input/output memory device
[NASA-CASE-KSC-10397] N72-25206
BUILDINGS
Apparatus and method of assembling building blocks by folding pre-cut flat sheets of material during on-site construction
[NASA-CASE-MSC-12233-1] N72-25454
BUOYS
Eole monitoring of drifting buoys and balloons in Southern Hemisphere for oceanographic and meteorological data
[NASA-TT-F-14279] N72-25345
BURNING RATE
Development of apparatus for testing burning rate and flammability of materials
[NASA-CASE-XMS-09690] N72-25913

C

C-130 AIRCRAFT
Flight tests of EC-130E aircraft with X band radome installed
[ENEA-71-45] N72-25007
C-135 AIRCRAFT
Communication support for Apollo by Apollo range instrumentation aircraft
[NASA-TM-X-68825] N72-25181
CABLES [ROPES]
Guide member for stabilizing cable of open shaft elevator
[NASA-CASE-KSC-10513] N72-25453
Simulated towed cable systems of nylon and steel strands, and two mathematical models for towline performance
N72-25730
CADMIUM COMPOUNDS
Spontaneous luminescence of CdSe and CdS at low temperature, excited by mercury lamp
[AD-737910] N72-25698
CALCIUM TUNGSTATES
Hyperfine structure in crystal calcium tungstate determined by combination of electron paramagnetic resonance and electron nuclear double resonance techniques
[NASA-CR-126751] N72-25683
CALCULUS OF VARIATIONS
Variational method for calculating flutter load stability of column
[REPT-105] N72-25882
CALIBRATING
Calibration curves for Apollo 16 command service module pulse code modulation downlink and onboard display
[NASA-TM-X-68322] N72-25850
CAMERA SHUTTERS
Effects of focal plane shutter and image motion compensation on Lunar Orbiter photography
N72-25415
CANADA
Defense, medical and industrial research in Canada for 1971
[DR-214] N72-25930
CARBON
Origin of satellite/resonance lines of boron, carbon, and nitrogen ions
[NASA-TM-X-68338] N72-25649
CARBON DIOXIDE
Molecular relaxation equilibrium conditions behind reflected shock waves with tables for carbon dioxide and nitrous oxide
[ARC-CP-1201] N72-25316
CARBON DIOXIDE LASERS
Effect of high pressure in CO2 laser
[AD-738270] N72-25508
Computer aided CO2 laser cavity length selection for reduced line competition
N72-25784
CARBON DIOXIDE REMOVAL
Service life and performance of one man electrochemical CO2 concentrator
[NASA-CR-114426] N72-25134
CARBON FIBERS
Lightweight rigid rectangular solar panel design utilizing improved composite sandwich of Al-core and carbon fibers
[ESRO-CR[P]-79] N72-25909
CARDIOTACHOMETERS
Method and criterion for evaluating ELF magnetic field interference effects on cardiac pacemaker function
[AD-737237] N72-25111
CARRIER FREQUENCIES
System performance of FDM systems using subcarrier channel frequencies from 4 to 200 kHz and channel information bandwidths of dc to 1, 2, 4, 8 and 16 kHz
[NASA-CR-123580] N72-25275
CASCADE FLOW
Calculation of annulus wall turbulent boundary layers in axial flow turbines noting flow deflections of blades
[ARC-CP-1196] N72-25314
CASSEGRAIN ANTENNAS
Dichroic subreflector for Rosman 2 dish antenna
N72-25795
CASTINGS
Ultrasonic tests of large steel castings
[TR-7202.568] N72-25460
CATEGORIES
Principles of theory of categories with models and coalgebraic functions
[DISS-4670] N72-25572
CATHODE RAY TUBES
Digital video system for displaying image and alphanumeric data on cathode ray tube
[NASA-CASE-NPO-11342] N72-25248
CAVITATION FLOW
Flow behavior of drops or bubbles moving in quiescent liquid under influence of gravitational force
N72-25297
CAVITIES
Effects of random excitation on cavity pressure and panel vibrations
[NASA-CR-112051] N72-25623
CAVITY RESONATORS
Cavity resonator for hydrogen maser
[NASA-CASE-HQN-10790-1] N72-25491
Microwave circuit for measuring complex dielectric constant of polar liquid by cavity perturbation method
[NOTA-INTERNA-352] N72-25637
CDC 6600 COMPUTER
Data acquisition and processing using CDC computers at CNES noting Eole and D-2 programs
N72-25236
CELESTIAL NAVIGATION
Orientation of nocturnally migrating birds based on reference to stellar positions and sky rotation
N72-25074
Analysis of pattern recognition capability of migratory birds and manner of orientation with stellar presentations
N72-25075
CERTIFICATION
Factors contributing to attrition from active airman status, particularly biological and medical characteristics
[FAA-AM-72-13] N72-25104
CESIUM
Production of high purity radioiodine by bombardment of cesium heat pipe
[NASA-CASE-LEW-11390-1] N72-25645
CHANNEL CAPACITY
System performance of FDM systems using subcarrier channel frequencies from 4 to 200 kHz and channel information bandwidths of dc to 1, 2, 4, 8 and 16 kHz
[NASA-CR-123580] N72-25275
CHANNELS [DATA TRANSMISSION]
Performance of convolution coding concatenated with MFSK modulation in Gaussian cha-
[NASA-TM-X-65905]

CHAPLYGIN EQUATION
Solution of Chaplygin equation for gas flow at high subsonic velocity
[NASA-TT-F-14254] N72-25303

CHARGED PARTICLES
Radio and space research 1968-1970, including upper ionosphere, energetic particles, and solar physics studies
[NP-19177] N72-25198
Measurement of currents associated with quiet auroral arc using vector magnetometer and lunar aspect sensor
N72-25324
Measurement of electric fields, magnetic fields, and charged particles in auroral band using Nike-Tomahawk rocket vehicle
N72-25326
Arc formation time, field emission, and impact of charged microparticles
[CERN-71-28] N72-25634
Calculation of finite, nonspherical nuclear systems using BHF method to determine intrinsic spectra, radii, quadrupole moments, and hexadecapole moments
[NASA-TN-D-6834] N72-25646
Computer simulation of plasmas, using particle models
[TID-25912] N72-25672

CHARGING
Development of device for simulating charge and discharge cycle of battery in synchronous orbit
[NASA-CASE-GSC-11211-1] N72-25020

CHECKOUT
Automatic and manual checkout equipment for testing space vehicle signal transmission lines
[NASA-CASE-KSC-10385] N72-25211
Checkout of multipoint sampling rake and exhaust emission of turbofan engines
[PB-207321] N72-25593

CHEMICAL ANALYSIS
Development of process for preparing N,N-dialkyltrifluoroacetamides and interpretation of process using gas chromatography
[NASA-TN-D-6836] N72-25161
Chemical analysis of copper base alloys using X ray spectrographs and radioisotope X ray analyzer
[BM-RI-7635] N72-25520
Combined geometric/chemical model for lattice dimensions of AB2 laves phases
[ARL/MET-86] N72-25691

CHEMICAL BONDS
Phase stability of bond type metallic binary systems
[NPL-DCS-15] N72-25697

CHEMICAL COMPOUNDS
Equipment and polyhydric chemicals for dispersing fog - Foggy Cloud 4 Project
[TOPR-178-1-121] N72-25154
Ultraviolet chromatographic detector for quantitative and qualitative analysis of compounds
[NASA-CASE-HQN-10756-1] N72-25428

CHEMICAL LASERS
Chemical lasers using low or zero gravity chemical reactions
[NASA-CASE-MSC-10986-2] N72-25489

CHEMICAL REACTIONS
Bibliography of 240 reactions in C-O-S and H-N-O-S systems
[NBS-SP-362] N72-25160
Development of process for preparing N,N-dialkyltrifluoroacetamides and interpretation of process using gas chromatography
[NASA-TN-D-6836] N72-25161
Numerical analysis of diffusion coefficients and characteristics of diffusion, adsorption, and reaction type processes
[DISS-4746] N72-25162
Chemical mixing in gas laser systems
[NASA-CR-126718] N72-25488
Chemical lasers using low or zero gravity chemical reactions
[NASA-CASE-MSC-10986-2] N72-25489

CHEMICAL TESTS
Radiation and chemical effects on totally depleted silicon diodes as nuclear particle detectors
N72-25786

CHEMISORPTION
Chemisorption of Co on tungsten III surface
N72-25157

CHEMORECEPTORS
Effect of chemical stimuli on orientation behavior of fish
N72-25090
Factors affecting migratory habits and orientation of sea turtles
N72-25091

CHEMOTHERAPY
Effectiveness of benactyzine hydrochloride and other antimotion sickness drugs combined with scopolamine
[AD-737220] N72-25118

CHROMIUM STEELS
Corrosion resistance of cold worked austenitic CrNi steels and Ni alloys in superheated steam
[EURFNR-954] N72-25534

CHROMOSPHERE
Basic physical properties involved in large-scale structure of solar interior and atmospheric layers
N72-25811

CIRCADIAN RHYTHMS
Effects of clock shift on orientation of migratory birds and deviations in initial orientation produced by varying amounts of clock shift
N72-25078
Environmental and endogenous timing factors as stimuli for bird migration
N72-25082

CIRCUIT DIAGRAMS
Circuitry and electrical performance of solid state Ku band IMPATT diode amplifier
[NASA-CR-122426] N72-25270
Electronic systems of multiwire proportional counter to measure extra-solar X ray fluxes during Black Brant 4 flight
[NASA-CR-115509] N72-25743

CIRCUIT PROTECTION
Development of process for forming insulating layer between two electrical conductor or semiconductor materials
[NASA-CASE-LEW-10489-1] N72-25447

CIRCUITS
Inductive-capacitive loops as load insensitive power converters
[NASA-CASE-ERC-10268] N72-25252
Fail-safe multiple transformer circuit configuration
[NASA-CASE-NPO-11078] N72-25262

CIRCULAR CYLINDERS
Effect of cooling on near wake of two dimensional circular cylinder at Mach number 6
N72-25298

CIRCULAR ORBITS
Numerical algorithm for determining optimal plane changes of three impulse transfers between non-coplanar circular orbits
[NASA-TM-X-64662] N72-25809
Strategy and logic used in space shuttle on-orbit rendezvous target program, for circular orbits
[NASA-CR-123713] N72-25836

CIVIL AVIATION
FAA index on aviation medicine and aeromedical data reports
[FAA-AM-72-1] N72-25103
Senate report on transportation of Government civil and military passengers and cargo by civil and military air carriers
[S-REPT-92-503] N72-25948
FAA national policies on overall missions and criteria for major subsystems
[REPT-1000.27-APP-1] N72-25949
Laws governing military use of civil aircraft
N72-25960

CLEAR AIR TURBULENCE
Optical radar technique using laser energy for studying atmosphere
N72-25357
Scattering mechanism of radar echoes from clear air
N72-25362
Using airborne scanning infrared spectrometer for remote detection of CAT
N72-25379

CLIMATOLOGY
Utilization of satellite meteorological observations for climatological research
[NASA-TT-F-723] N72-25582
Aerological data at Uccle [Belgium] over years 1966 to 1970
N72-25590

CLINICAL MEDICINE
Automatic system for measuring and monitoring systolic and diastolic blood pressure in humans
[NASA-CASE-MSC-13999-1] N72-25142

CLOSED ECOLOGICAL SYSTEMS
Decreased resistance to infections of respiratory system in closed ecological system
[NASA-CR-115641] N72-25061
Plant cultivation in closed ecological system in space flight
[JPRS-56129] N72-25106

CLOUD PHOTOGRAPHY
European cloud reliefs constructed from ESSA 8 satellite observations during fall of 1971
[QR-3-PT-3] N72-25577

CLOUD SEEDING
Cloud seeding project for increasing water supply in Montana reservoir during five year period
[PB-206948] N72-25401

CLOUDS
Gas cloud collisions as radiation sources for quasi-stellar objects
[NASA-CR-126723] N72-25742

CLOUDS [METEOROLOGY]
Radar observations of birds migrating in opaque cloud cover to determine effects of wind and meteorological conditions
N72-25073
Optical radar technique using laser energy for studying atmosphere
N72-25357
Quasi-objective method for deriving 500-mb geopotential heights with aid of satellite cloud observations
[NOAA-TR-NESS-55] N72-25583

CLUTTER
HF backscatter system for collecting auroral clutter data
[AD-738305] N72-25203

COAL
Research projects in energy sources, energy development, and exploitation
[ORNL-EIS-72-18-VOL-1] N72-25635

COASTS
Water quality simulation model for well-mixed estuaries and coastal seas
[P-4772-1] N72-25332
Abstracts on research along coastal zone and shallow water margins of continent
[AD-735486] N72-25402

COBALT ALLOYS
Thermal compatibility of production grade [Pu-238]O2 and nickel and cobalt base alloys
[MLM-1864] N72-25535

COCKPITS
Development of standardized method for evaluating physical geometry of aircrew stations - Vol. 1
[AD-738006] N72-25015

CODING
Performance of convolution coding concatenated with MFSK modulation in Gaussian channel
[NASA-TM-X-65905] N72-25190
Handbook for coding radiosonde reports by U.S. weather stations
N72-25587

COEFFICIENTS
Spectra of modulated galactic cosmic rays in terms of Compton-Getting coefficient
[NASA-TM-X-65901] N72-25722

COENZYMES
Bioassay of flavin coenzymes
[NASA-CASE-GSC-10565-1] N72-25149

COHERENT LIGHT
Principles of holography and various methods for production of holograms
N72-25495
Comparison of coherent and conventional light sources to show advantages of coherent light for optical experiments
N72-25497
Application of aerodynamic holography for optical recording and flow visualization in wind tunnels and research facilities
N72-25498
Calculation of diffraction efficiency and signal-to-noise ratio for two dimensional and volume diffuse-signal-beam holograms
N72-25500
Applications of lasers as indirect light source for high speed photography
N72-25504

COHERENT RADIATION
Application of laser beams for measurement of aerodynamic flow fields at supersonic and hypersonic speeds
N72-25503
Development and characteristics of optical equipment for collimation of laser energy
[AD-738288] N72-25509

COLLIMATORS
Development and characteristics of optical equipment for collimation of laser energy
[AD-738288] N72-25509

COLLISIONLESS PLASMAS
Wentzel-Kramer-Brillouin theory of Kelvin-Helmholtz instability in high beta collisionless plasmas
N72-25675

COLLOIDS
Control, reproducibility, and predictability for annular colloid emitter
[NASA-CR-122385] N72-25710

COLOR
Universal system for assigning colors to terrain
[AGARD-AG-159] N72-25346

COLOR TELEVISION
Analysis of allowable error rate in pulse code modulation system used with color television signal transmission
[BBC-1972/14] N72-25175

COLUMNS [SUPPORTS]
Variational method for calculating flutter load stability of column
[REPT-105] N72-25882

COMBAT
Impact of computers on military operations and decisions
[P-4728] N72-25221

COMBUSTIBLE FLOW
Research for developing computer program for gas turbine combustor flow
[NASA-CR-126724] N72-25702

COMBUSTION CHAMBERS
Heat transfer and laminar incompressible boundary layer on corrugated wall applied to vaporizing combustion chamber
[DLR-FB-71-107] N72-25317

Coaxial injector for mixing liquid propellants within combustion chambers
[NASA-CASE-NPO-11095] N72-25455
Aerothermodynamic integration model, including combustor design, flow distribution, and heat transfer problems
[NASA-CR-112058] N72-25713
Concentration of injected helium tracer gas in rocket combustion chamber
N72-25912

COMBUSTION PHYSICS
Thermodynamic and gas dynamic properties of solid ammunition ignition
[TL-1971-17] N72-25920
Analysis of powder residue following one dimensional combustion and dependence on initial temperature and pressure
N72-25926

COMBUSTION STABILITY
Solution to nonlinear equations of motion for gas in solid propellant rocket engine
N72-25914

COMETS
Solar physics, planetary atmospheres, comets, and earth aurora and upper atmosphere, studied with satellite, rocket, and space probe data
N72-25805
Velocity and mass flux, physical characteristics, and classification and relation to comets of radio and radar meteors - overview
[NASA-CR-112639] N72-25808
Atmospheric compositions of planets, satellites, and comets
N72-25817

COMMAND MODULES
Calibration curves for Apollo 16 command service module pulse code modulation downlink and onboard display
[NASA-TM-X-68322] N72-25850

COMMUNICATING
Communication between computers using two identical communications links
[NASA-CASE-NPO-11161] N72-25207

COMMUNICATION EQUIPMENT
Flight tests of Apollo spacecraft communications systems
[NASA-TN-D-6852] N72-25186
Development of large, furlable spacecraft antennas using conical main reflectors with two and four reflection configurations
[NASA-CR-126966] N72-25193
Development and characteristics of simulation facility for analyzing communication systems
[AD-738297] N72-25200
Calibration curves for Apollo 16 command service module pulse code modulation downlink and onboard display
[NASA-TM-X-68322] N72-25850

COMMUNICATION SATELLITES
Techniques for control of phased array antenna used in ground terminal of satellite communication system
[AD-738303] N72-25202

COMMUTATORS
Thick film circuitry for brushless motor commutator and control
N72-25766

COMPATIBILITY
Chemical compatibility between tungsten and uranium carbide alloys
[NASA-CR-126869] N72-25545

COMPILERS
Installation and use of MARK 3 compiler for advanced targeting study
[AD-735619] N72-25246

COMPLEX SYSTEMS
Statistical modeling for predicting events and trends of complex systems
N72-25136

COMPONENT RELIABILITY
Flightweight components and water cooled test adapters for hypersonic engine
[NASA-CR-112055] N72-25711

COMPOSITE MATERIALS
Method for making fiber composites with high strength at high temperatures
[NASA-CASE-LEW-10424-2-2] N72-25539
Thermal aspects of using filamentary composite materials for airframes on atmospheric entry spacecraft
[SD-72-SH-0015] N72-25542
Lightweight rigid rectangular solar panel design utilizing improved composite sandwich of Al-core and carbon fibers
[ESRO-CR[P]-79] N72-25909

COMPRESSED AIR
Visual evoked response as measure of nitrogen narcosis in divers breathing compressed air from 0 to 250 feet
[AD-737208] N72-25114

COMPRESSING
Optimum shape and size for edge stiffeners for thin walled compression elements
[TN-7] N72-25893

COMPRESSION LOADS
Effects of eccentricities and lateral pressure on design of stiffened compression panels
[NASA-TN-D-6784] N72-25904

COMPUTER DESIGN
Research projects, applied science, and technical developments in East European scientific organizations and institutions
[JPRS-56106] N72-25959

COMPUTER GRAPHICS
Computerized design of printed circuits using graphical display device in conversational mode
[FP/LP-DR5-1.501/71] N72-25243

COMPUTER PROGRAMMING
Analog computer program for analysis of extended electrocardiographic monitoring
N72-25053
Computer programming and optimization of function subject to constraint
[AAR-99] N72-25225
Computer programming for regulation of switchgear demands
N72-25226
Turbulent boundary layer nozzle analysis and computer program
[NASA-TM-X-64663] N72-25308
Computer program for automatic determination of gases in environmental chamber during spacecraft testing
N72-25788

COMPUTER PROGRAMS
Development and application of computer program for predicting unsteady loads caused by trailing edge control surface motions at subsonic speed
[NASA-CR-2003] N72-24992
Applications of computers for flight test and evaluation of helicopters based on frequency analyses of load curves on main and tail rotors
[NASA-TT-F-14283] N72-24993
Computer program for predicting performance, noise, weight, and cost of general aviation aircraft propellers for 1980 time period
[NASA-CR-2066] N72-25005
Computer programs for improved methods for evaluating physical compatibility of crew members with crew stations - Vol. 3
[AD-738007] N72-25016
Manual for computer analysis of structural strain and hypervelocity impacts
[NASA-CR-126749] N72-25219
FORTRAN programs for astronomy
[RR-102] N72-25220
Impact of computers on military operations and decisions
[P-4728] N72-25221
Computer code for generating spatial-angular moments of neutron flux in infinite medium
[NBS-TN-725] N72-25227
Satellite data acquisition and processing, noting real time operation, spacecraft control, computers, and software - conferences
[ESRO-SP-69] N72-25233
Development of finite difference turbulent boundary layer computer program with consideration of mass transfer wall cooling and equilibrium chemistry effects
[NASA-CR-126728] N72-25301
Sequence of FORTRAN subroutines for conversion of eigenvalue problem into standard form
[REPT-18] N72-25557
Use of computer programs as navigation aid during contingency lunar mission planning
[NASA-TN-D-6853] N72-25600
Development of computer program to describe uplink and downlink digital systems for manned spacecraft orbital missions - Vol. 2
[NASA-CR-115663] N72-25604
Research for developing computer program for gas turbine combustor flow
[NASA-CR-126724] N72-25702
Computer program for solving heat transfer problems by optical structural analysis
N72-25763
Thermal finite element computer program for variance analysis on predicted temperature field
N72-25764

COMPUTER STORAGE DEVICES
Design of oligatomic thin film computer storage device
[NASA-CR-123635] N72-25213
Feasibility evaluation of oligatomic computer storage device
[NASA-CR-123533] N72-25214
Operation manual for oligatomic computer storage device
[NASA-CR-123634] N72-25215
Mass storage simulation program for data processing facility design
N72-25798

COMPUTER SYSTEMS PROGRAMS
JOSS - conversational computing system for computer novice
[R-918] N72-25935
Systems analysis for consumer product safety standards
N72-25982

COMPUTER TECHNIQUES
Modification of manually operated fuel-cell system to provide monitoring and control by digital computer
[NASA-TM-X-2575] N72-25025
Automatic analysis of ECG at rest, during and after exercise with two computer systems
N72-25052
Computer aided CO2 laser cavity length selection for reduced line competition
N72-25784
Digital computer technique for servo and control systems of large antennas
N72-25794

COMPUTERIZED DESIGN
Computerized design of printed circuits using graphical display device in conversational mode
[FP/LP-DR5-1.501/71] N72-25243
Computer programs for analysis and design of resonators
[REPT-16] N72-25897

COMPUTERIZED SIMULATION
Design and performance of real time computerized control system for large antenna
[NASA-CR-122417] N72-25194
DARE 3, on-line time-shared all-digital simulation system
N72-25212
Computerized simulation for construction and calculation of properties of particulate solids in two and three dimensional systems
[BM-BULL-658] N72-25228
Minimax solution of second order phase lock loop acquisition by computerized simulation
N72-25555
Computer simulation of plasmas, using particle models
[TID-25912] N72-25672
Computer program for simulating spinning mode of orbiting flexible spacecraft
N72-25762
Computerized simulation of X ray telescope geometrical optics
N72-25780
Discrete event simulation in operations research
[ETN-5] N72-25990

COMPUTERS
Communication between computers using two identical communications links
[NASA-CASE-NPO-11161] N72-25207
On-line programming uses for computer systems research
[NASA-CR-122427] N72-25224
Computer development, noting improvements by multiprogramming, buffer stores, and software evolution
N72-25234

CONDUCTIVE HEAT TRANSFER
Experimental method for measuring heat transfer in hypersonic aerodynamic models
[REPT-32] N72-25918
Proceedings of conference on thermal conductivity
[CONF-710938] N72-25927

CONFERENCES
Proceedings of conference on medical aspects of spatial disorientation and effects on safe aircraft operation
[AGARD-CP-95-PT-1] N72-25031
Aeromedical requirements and examination techniques for aircrews - conference
[AGARD-CP-95-PT-2] N72-25048
Proceedings of conference on animal orientation and navigation capabilities
[NASA-SP-262] N72-25062
Satellite data acquisition and processing, noting real time operation, spacecraft control, computers, and software - conferences
[ESRO-SP-69] N72-25233
Conference papers dealing with remote probe techniques for observing and measuring physical composition and dynamical structure of atmosphere
[NASA-CR-126787] N72-25347
Proceedings of conference on applications of laser technology for aerodynamic measurements
[AGARD-LS-49] N72-25493
Conference on technological developments in satellite communications, tracking, antenna arrays, attitude control, orbit calculations, and instrumentation
[NASA-SP-295] N72-25755
Solar system, solar physics, planetary atmospheres and structure, and origin of planets and moon - conference
[NASA-SP-300] N72-25810
Proceedings of conference on thermal conductivity
[CONF-710938] N72-25927
Operational principles of international cooperation in space exploration - conference
[S-DOC-92-57] N72-25951
Papers presented at conference on system safety in government and industry
[NASA-TM-X-68369] N72-25961

CONFIDENCE LIMITS
Use of computer programs as navigation aid during contingency lunar mission planning
[NASA-TN-D-6853] N72-25600

Management of confidence limits in lunar module design
N72-25978

CONFORMAL MAPPING
Riemann functions and conformal mapping for construction of complex systems
[DISS-4707] N72-25565

CONGRESS
Astronauts report to House Committee on Apollo 16 flight, EVAs, lunar and earth photographs, and scientific experiments
N72-25835
Indexes for inventory of energy research
N72-25931
NASA budget authorization for 1973
[S-REPT-92-779] N72-25933
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 1
N72-25936
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 2
N72-25937
Appropriations for NASA manned space flight program during 1973
N72-25938
Congressional hearings on 1973 budget request by NASA
N72-25939
Hearings before House Committee on budget requests for military construction and family housing
N72-25943
Hearings before House Committee on budget requests for Army, Safeguard, and Defense Agencies construction
N72-25944
Congressional hearings concerning aeronautical research
N72-25945
Hearings concerning FY 72 transportation appropriations
N72-25946
Amended bill establishing National Advisory Committee on Oceans and Atmosphere
[S-REPT-92-333] N72-25947
Senate report on transportation of Government civil and military passengers and cargo by civil and military air carriers
[S-REPT-92-503] N72-25948
International liability and space exploration
N72-25957
Laws governing military use of civil aircraft
N72-25960

CONICAL SHELLS
Development of theory for propagation of elastic-plastic waves in truncated conical shells
[AD-737100] N72-25910

CONSTANTS
Spectral line constants, solar equivalent widths, and desaturated values for late stars
[BULL-168] N72-25746

CONSTRUCTION
Hearings before House Committee on budget requests for military construction and family housing
N72-25943

CONSTRUCTION MATERIALS
Apparatus and method of assembling building blocks by folding pre-cut flat sheets of material during on-site construction
[NASA-CASE-MSC-12233-1] N72-25454

CONSUMERS
Systems analysis for consumer product safety standards
N72-25982

CONTAMINATION
Portable tester for monitoring bacterial contamination by adenosine triphosphate light reaction
[NASA-CASE-GSC-10879-1] N72-25413
Role of hydrogen in formation of massive voids during electron beam welding of titanium and effect of various treatments on hydrogen contamination and elimination
[RM-545] N72-25481

CONTINENTAL SHELVES
Abstracts on research along coastal zone and shallow water margins of continent
[AD-735486] N72-25402
Applicability of NASA contract quality management and failure mode effect analysis procedures to USGS Outer Continental Shelf oil and gas lease management program
[NASA-TM-X-2567] N72-25955

CONTINUOUS RADIATION
Incoherent and coherent CW laser systems for remote atmospheric probing
N72-25355
Comparison of continuum radiation and spectral line radiation in W3 and W51 regions
[RR-96] N72-25748

CONTINUUM MECHANICS
Validity of energy criterion in predicting critical load stability of continuous system
[REPT-63] N72-25885

CONTOURS
Contouring algorithms over triangular meshes for contour map making
[NPL-NAC-10] N72-25245

CONTRACT NEGOTIATION
Use of management techniques and modern safety engineering to achieve safety requirements in contractual agreements
N72-25973

CONTRACTION
Effect of middle ear muscle contractions on hearing and echo processing in Mustache Bat
N72-25084
Address contractions of variables in ALGOL 60
[NPL-NAC-14] N72-25244

CONTROL EQUIPMENT
Development of device for simulating charge and discharge cycle of battery in synchronous orbit
[NASA-CASE-GSC-11211-1] N72-25020

CONTROL SURFACES
Development and application of computer program for predicting unsteady loads caused by trailing edge control surface motions at subsonic speed
[NASA-CR-2003] N72-24992

CONTROLLABILITY
Controllability of linear, time invariant, delay differential system
[NASA-TM-X-65888] N72-25561

CONTROLLERS
Stabilizing control systems, and controllers structured like passive mechanical systems
[NASA-TN-D-6731] N72-25277

CONVERGENCE
Convergence theorems in averaging theory
[TN-34] N72-25571

CONVERGENT NOZZLES
Supersonic jet flow distribution from convergent nozzles
[ARC-CP-1197] N72-25315

CONVOLUTION INTEGRALS
Performance of convolution coding concatenated with MFSK modulation in Gaussian channel
[NASA-TM-X-65905] N72-25190

COOLING
Effect of cooling on near wake of two dimensional circular cylinder at Mach number 6
N72-25298
Solidification time of metal drops in vacuum, considering heat removal by radiation and evaporation
[RM-544] N72-25532

COPPER ALLOYS
Influence of grain size and precipitate distribution on creep behavior of copper base alloy
[TN-12] N72-25513
Chemical analysis of copper base alloys using X ray spectrographs and radioisotope X ray analyzer
[BM-RI-7635] N72-25520

COPPER COMPOUNDS
Nonisothermal thermogravimetry of decomposition reactions for copper sulfate and oxysulfate in flowing nitrogen and air
[BM-RI-7638] N72-25519

CORIOLIS EFFECT
Effect of coriolis force on stability of rotating hydromagnetic systems and condition for instability
[NASA-TM-X-65908] N72-25826
Coriolis force effect on stability of rotating magnetic stars in hydrostatic equilibrium
[NASA-TM-X-65899] N72-25831

CORROSION
Analysis of physical properties of materials to determine correlation with resistance to corrosion
[AD-738162] N72-25537

CORROSION RESISTANCE
Corrosion resistance of cold worked austenitic CrNi steels and Ni alloys in superheated steam
[EURFNR-954] N72-25534

CORRUGATED PLATES
Heat transfer and laminar incompressible boundary layer on corrugated wall applied to vaporizing combustion chamber
[DLR-FB-71-107] N72-25317
Theoretical elastic analysis for in-plane shear of corrugated plate with curvilinear corrugations and with discrete attachments between ends of corrugations and surrounding members
[NASA-CR-2080] N72-25902

COSMIC RAYS
Geophysics and space data
[AD-738327] N72-25397
Distribution of cosmic ray sources, map of sky, and model of galactic field
N72-25717
Spectra of modulated galactic cosmic rays in terms of Compton-Getting coefficient
[NASA-TM-X-65901] N72-25722
Galactic cosmic ray intensity, sunspot number, 10.7 cm radio flux, and geomagnetism
[AD-737848] N72-25728

COSMOS SATELLITES
Photographic tracking and orbit calculation of cosmos 268 to determine upper atmosphere zonal wind speeds
[RAE-TR-71202] N72-25838

COST EFFECTIVENESS
Cost effectiveness of solar cell space power systems
[NASA-TM-X-68054] N72-25022

COST ESTIMATES
Final cost estimates for engine configurations and schedules selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123673] N72-25708
Hearings before House Committee on budget requests for military construction and family housing
N72-25943

COUNTING CIRCUITS
Counting digital filters of nonrecursive type
[NASA-CASE-NPO-11821-1] N72-25222

COWLINGS
Subsonic behavior of three annular airfoils for turbofan engine cowlings
[ARC-R/M-3688] N72-24999

CRAB NEBULA
Interstellar absorption of Crab nebula soft X ray flux and X ray spectrum of Crab pulsar
N72-25734

CRACKING [FRACTURING]
Brittle fracture and cracks in steels, joints, and metal sheets
[JPRS-56070] N72-25527

CRACKS
Influence of cracks on tensile strength of steel test bar and on strength and plasticity of aluminum alloys
N72-25530

CREEP PROPERTIES
Effects of creep and low cycle fatigue tests on alpha iron grain boundaries at 450 to 700 C
[TN-10] N72-25512
Influence of grain size and precipitate distribution on creep behavior of copper base alloy
[TN-12] N72-25513
Creep, tensile and thermal properties, and microstructure of Zn-Al alloys
[BM-RI-7538] N72-25518
Tensile strength and creep properties of fiber/epoxy resin composites
[NASA-TM-X-68053] N72-25544
Mechanical behavior of alloys and metals during high temperature deformation
[REPT-108] N72-25681

CREEP RUPTURE STRENGTH
Effects of temperature, grain size, and strain rate on fracture behavior of Inconel alloy X-750
[TN-11] N72-25905

CRITICAL LOADING
Validity of energy criterion in predicting critical load stability of continuous system
[REPT-63] N72-25885

CROSS CORRELATION
Piecewise cross correlation technique for analyzing outputs of remote detection devices to eliminate noise from optical background fluctuations
N72-25381
Field test evaluation of optical cross beam system for measuring convective wind velocities
N72-25382

CROSS COUPLING
Energy-momentum relation for weakly coupled optical polarons and phonon cross exchange
N72-25653

CRUDE OIL
Research projects in energy sources, energy development, and exploitation
[ORNL-EIS-72-18-VOL-1] N72-25635
Reliability analysis on petroleum industry requirements
N72-25986

CRYOGENIC EQUIPMENT
Polymeric film-metal-film sandwich laminate for reduced permeability material of cryogenic expulsion bladder
[NASA-CR-120892] N72-25159
Performance tests and evaluation of gas generating and charging equipment for handling gaseous and cryogenic materials
[AD-738120] N72-25484

CRYOGENIC STORAGE
Development of method for determining buckling characteristics of disposable liquid hydrogen tank used on space shuttles
[RM-540] N72-25906

CRYOGENICS
Numerical analysis for optimal dimensions of semiconductors in cryogenic systems
[DISS-4656] N72-25690

CRYSTAL DEFECTS
Effect of grain boundary increase and intragrain defects in austenite structure on carbon diffusion
[NASA-TT-F-14272] N72-25516

CRYSTAL DISLOCATIONS
Relationship of dislocations of silicon to solar cell current loss at low temperature
[NASA-TM-X-68055] N72-25023

CRYSTAL GROWTH
Gravity influenced parameters affecting solidification and crystal growth in tin
[NASA-TM-X-53999] N72-25693

CRYSTAL LATTICES
Combined geometric/chemical model for lattice dimensions of AB2 laves phases
[ARL/MET-86] N72-25691
CRYSTAL STRUCTURE
Crystal structure of olivine and polymorphism
[NASA-TT-F-14243] N72-25687
CRYSTALS
Infrared tunable laser with wavelength-selective reflectors, lasable dye solutions, and nonlinear mixing crystal
[NASA-CASE-ARC-10463-1] N72-25268
CUES
Function of visual cues in orientation navigation systems of desert ants
N72-25088
CULTURE TECHNIQUES
Development of variable angle device for positioning test tubes to permit optimum drying of culture medium
[NASA-CASE-LAR-10507-1] N72-25284
CYBERNETICS
Mathematic modeling, automata theory, speech synthesis, and mechanical model of heart and lungs
[JPRS-56072] N72-25135
CYCLIC LOADS
Inelastic behavior of metals subjected to various types of loads
[AD-738326] N72-25538
Development of device for simulating cyclic thermal loading of flexible materials by application of mechanical stresses and deformations
[NASA-CASE-LAR-10270-1] N72-25877
Development of computer program for cyclic deformation and fatigue properties of materials under axial and flexural conditions
[TN-4] N72-25892
CYGNUS CONSTELLATION
X ray spectroscopy of Cygnus region
[NASA-TM-X-65903] N72-25723
CYLINDERS
Finite element method in dynamic structural analysis on axisymmetric vibrating cylinders
[REPT-106] N72-25884
CYLINDRICAL SHELLS
Effects of axisymmetric imperfections on buckling of axially loaded cylindrical shells
[REPT-80] N72-25889

D

D REGION
D region electron density profiles from differential phase partial reflection measurements
[NASA-CR-126725] N72-25329
Approximation of N[h] profile by exponential functions for D region
N72-25389
Electron density profiles and models for flare time D region densities
[RSD-68] N72-25718
DAMAGE
Damage due to local internal electric discharges in insulating polymeric materials
N72-25552
DAMPING
Dampometer for measuring amount of damping in wind tunnel test model
[NASA-CR-123671] N72-25289
Development of Liapunov functional for continuous, nonconservative systems with damping
[REPT-66] N72-25886
Mathematical model of Kelvin-Voigt viscoelastic material and influence of internal damping
[REPT-110] N72-25895
DATA ACQUISITION
Application of statistical analysis techniques for determining orientation and navigation characteristics of animals
N72-25066
Satellite data acquisition and processing, noting real time operation, spacecraft control, computers, and software - conferences
[ESRO-SP-69] N72-25233
Data acquisition and processing using CDC computers at CNES noting Eole and D-2 programs
N72-25236
Data acquisition for spacecraft control noting data display techniques at ESOC
N72-25237
Real time data acquisition and processing using IBM computers
N72-25240
Data acquisition and processing systems for ESRO satellites, noting production control
N72-25241
Data acquisition and processing for Explorer 33 satellite
[NASA-TM-X-65894] N72-25828
DATA CONVERTERS
Analog signal to discrete time converter
[NASA-CASE-ERC-10048] N72-25251
DATA LINKS
Nimbus 4 interrogation, recording, and location system for data collection from remote atmospheric sounding balloons
N72-25777
DATA PROCESSING
Application of statistical analysis techniques for determining orientation and navigation characteristics of animals
N72-25066
Transmission, recording, and processing of data telemetered from WRESAT satellite
[WRE-TN-516-[T]] N72-25195
Satellite data acquisition and processing, noting real time operation, spacecraft control, computers, and software - conferences
[ESRO-SP-69] N72-25233
Data acquisition and processing using CDC computers at CNES noting Eole and D-2 programs
N72-25236
Data processing requirements for experimenters with constraints on spacecraft telemetry, orbit, and attitude
N72-25238
Real time data acquisition and processing using IBM computers
N72-25240
Data acquisition and processing systems for ESRO satellites, noting production control
N72-25241
Ground data processing requirements for Ariel satellites
N72-25242
Radiometer and proton monitor data, processing, and hardware on ITOS satellites
[NOAA-TM-NESS-29] N72-25721
Logic system for design and fabrication of telemetry ground data processing equipment
N72-25797
Mass storage simulation program for data processing facility design
N72-25798
NOAA satellite observations and ground support at research and data processing facilities - 1971
N72-25806
Data acquisition and processing for Explorer 33 satellite
[NASA-TM-X-65894] N72-25828
DATA PROCESSING EQUIPMENT
Analysis of techniques and computer programs for extracting stability derivative information from flight test records
[NASA-CR-2016] N72-24991
Applications of computers for flight test and evaluation of helicopters based on frequency analyses of load curves on main and tail rotors
[NASA-TT-F-14283] N72-24993
Development and characteristics of telemetry system using computer-accessed circuits and remotely controlled from ground station
[NASA-CASE-NPO-11358] N72-25172
Thick film field effect transistor circuits for space flight data processing system
N72-25774
DATA RECORDING
High speed microfilm plotter for data recording, emphasing software packages
N72-25235
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Apr. - June 1971
N72-25390
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Jul. - Sep. 1971
N72-25391
Developmental model of instrumentation record/reproduce system
N72-25799
DATA RETRIEVAL
Data requirements analysis for operation of user-oriented safety data bank
N72-25964
DATA STORAGE
Design of lunar module signal conditioning, caution and warning, and data storage electronics instrumentation subsystems
[NASA-TN-D-6845] N72-25856
DATA SYSTEMS
Practical application of mishap data in Army aircraft system safety programs
N72-25967
DATA TRANSMISSION
Transmission, recording, and processing of data telemetered from WRESAT satellite
[WRE-TN-516-[T]] N72-25195
Handbook for coding radiosonde reports by U.S. weather stations
N72-25587
Telemetry remote module for data transmission to central control core
N72-25775
DC 9 AIRCRAFT
Aircraft accident involving DC-9 charter flight on instrument landing approach to Huntington, West Virginia airport on 14 November, 1970
[NTSB-AAR-72-11] N72-25006
Aircraft accident report concerning DC-9 aircraft contact with ocean surface and subsequent emergency landing at Martha's Vineyard, Massachusetts, June 22, 1971
[PB-207101] N72-25013
DECIMETER WAVES
Galactic cosmic ray intensity, sunspot number, 10.7 cm radio flux, and geomagnetism
[AD-737848] N72-25728
DECISION MAKING
Impact of computers on military operations and decisions
[P-4728] N72-25221
Comparison of risk and benefits in management decision making policies
N72-25962
DECOMPOSITION
Nonisothermal thermogravimetry of decomposition reactions for copper sulfate and oxysulfate in flowing nitrogen and air
[BM-RI-7638] N72-25519
Numerical analysis of torsion decomposition of finite CW-Complexes
[DISS-4460] N72-25567
DECONTAMINATION
Heat exchanger and decontamination system for multistage refrigeration unit
[NASA-CASE-NPO-10634] N72-25619
DEEP SPACE
Experiments for determining potential uses of future deep space missions in studies of relativistic gravity
[NASA-CR-126746] N72-25928
DEFECTS
Scanning electron microscope for detection of metallization defects in semiconductor devices
N72-25803
Effects of axisymmetric imperfections on buckling of axially loaded cylindrical shells
[REPT-80] N72-25889
DEFENSE
Impact of computers on military operations and decisions
[P-4728] N72-25221
DEFENSE PROGRAM
Defense, medical and industrial research in Canada for 1971
[DR-214] N72-25930
DEFLECTION
Deflection of electric arc by asymmetrical heating using high frequency pulsed radiation
[ISL-29/71] N72-25282
DEFORMATION
Optical diffraction for two-dimensional Fourier amplitude transformation in study of rock fabrics and deformation
[AD-737390] N72-25408
Development of device for simulating cyclic thermal loading of flexible materials by application of mechanical stresses and deformations
[NASA-CASE-LAR-10270-1] N72-25877
DEGRADATION
Mathematical model for magnesium fluoride degradation due to electron irradiation
[ONERA-DERTS-NT-02-29] N72-25553
DELTA MODULATION
Ultrasonic signal counting technique for flaw detection in aluminum welds
[NASA-CR-123649] N72-25464
DENSITY DISTRIBUTION
Characteristics of faint stars at high galactic latitudes determined by UBV photometry
N72-25417
DEPOSITION
Process for depositing pure metals by irradiating liquids
[NASA-CASE-LEW-10906-1] N72-25164
DESALINIZATION
Metallic osmotic membranes for desalinization of sea water
[CEA-R-4129] N72-25533
DETACHMENT
Analysis of aircraft pilot reports on occurrence of unreality and detachment during flight and relationship to spatial disorientation
N72-25042
DETECTION
Short range obstacle detector for surface vehicles using laser diode array
[NASA-CASE-NPO-11856-1] N72-25490
DETECTORS
Hydrogen fire blink detector for high altitude rocket or ground installation
[NASA-CASE-MFS-15063] N72-25412
DETONATION
Detonation of secondary high explosives by Q switched ruby laser
[NASA-CR-126741] N72-25492
DEUTERIUM
Gas chromatographic method for analyzing hydrogen deuterium mixtures
[NASA-CASE-NPO-11322] N72-25146
Abundances in sun and solar wind and estimates of deuterium and helium 3 in protosolar gas
N72-25725

DEUTERIUM COMPOUNDS
Collisional energy transfer during vibrational excitation of HF and DF at high temperature and pressure
[AD-738296] N72-25168
DIAGNOSIS
Clinical electrodiagnosis in prognosis of lower motor neuron lesions
N72-25058
Signal and data processing technology for diagnostic techniques in phonocardiography
N72-25801
DIAMINES
Synthesis of siloxane containing epoxide and diamine polymers
[NASA-CASE-MFS-13994-2] N72-25148
DIASTOLE
Automatic system for measuring and monitoring systolic and diastolic blood pressure in humans
[NASA-CASE-MSC-13999-1] N72-25142
DIATOMIC GASES
High resolution nonlinear spectroscopy applied to line profile of Raman resonance in hydrogen gas
[NOTA-INTERNA-349] N72-25662
DICHROISM
Dichroic subreflector for Rosman 2 dish antenna
N72-25795
DICTIONARIES
Glossary and extended definitions of terms used in science policy
N72-25934
DIELECTRIC PROPERTIES
Development of procedure for precise measurement of dielectric loss based on frequency measurement
[TN-174] N72-25278
Microwave circuit for measuring complex dielectric constant of polar liquid by cavity perturbation method
[NOTA-INTERNA-352] N72-25637
DIESEL ENGINES
Noise level measurements, and octave band analysis for large maritime type diesel engine operating under full-load conditions
[TR-7202.564] N72-25622
DIFFERENTIAL CALCULUS
Algorithm for calculating eigenvalues in quotient-difference transformation of tridiagonal matrix
[DISS-4624] N72-25568
DIFFERENTIAL EQUATIONS
Axiomatic designations of logic differential equations used in modeling dynamic systems
N72-25137
DIFFRACTION PATTERNS
Calculation of diffraction efficiency and signal-to-noise ratio for two dimensional and volume diffuse-signal-beam holograms
N72-25500
DIFFUSION THEORY
Numerical analysis of diffusion coefficients and characteristics of diffusion, adsorption, and reaction type processes
[DISS-4746] N72-25162
DIGITAL COMPUTERS
Methods and digital computer system for automated speech output
N72-25139
Techniques for control of phased array antenna used in ground terminal of satellite communication system
[AD-738303] N72-25202
DIGITAL FILTERS
Counting digital filters of nonrecursive type
[NASA-CASE-NPO-11821-1] N72-25222
DIGITAL SYSTEMS
Digital processors for improving optimum performance of MTI
[AD-738298] N72-25201
Transmitter subsystem drawings for DC/EC digital test system
[NASA-CR-115597] N72-25230
System inputs, transmitter, and receiver of DC/EC digital system tests
[NASA-CR-115606] N72-25231
Assembly drawings of receiver unit for data compression/error correction digital test system
[NASA-CR-115607] N72-25232
Digital video system for displaying image and alphanumeric data on cathode ray tube
[NASA-CASE-NPO-11342] N72-25248
Modulo-M counter for digital subsystem for generating spacecraft timing and control signals
[NASA-CR-126971] N72-25276
Development of computer program to describe uplink and downlink digital systems for manned spacecraft orbital missions - Vol. 2
[NASA-CR-115663] N72-25604
Precision digital solar aspect sensor
N72-25782
Digital computer technique for servo and control systems of large antennas
N72-25794
DIGITAL TO ANALOG CONVERTERS
Digital to analog converter with parallel input/output memory device
[NASA-CASE-KSC-10397] N72-25206
DIMENSIONS
Combined geometric/chemical model for lattice dimensions of AB2 laves phases
[ARL/MET-86] N72-25691
Pressure vessel analysis of shape, dimensions, and loads
[WTHD-35] N72-25901
DIODES
Amplitude limiters and trigger switches with biased diodes for threshold stabilization of alternating voltage
N72-25265
Circuitry and electrical performance of solid state Ku band IMPATT diode amplifier
[NASA-CR-122426] N72-25270
Development of method and apparatus for detecting surface ions on silicon diodes and transistors
[NASA-CASE-ERC-10325] N72-25457
Short range obstacle detector for surface vehicles using laser diode array
[NASA-CASE-NPO-11856-1] N72-25490
Radiation and chemical effects on totally depleted silicon diodes as nuclear particle detectors
N72-25786
DIPOLE ANTENNAS
Development of control for wide band dipole antenna with high directivity of shaped radiation pattern
[PB-206688] N72-25205
DIRECT CURRENT
Dc to ac to dc converter with transistor driven synchronous rectifiers
[NASA-CASE-GSC-11126-1] N72-25253
DIRECT LIFT CONTROLS
Fixed base simulator study of direct lift control on VC-10 aircraft
[ARC-CP-1199] N72-25010
DIRECTIONAL ANTENNAS
Development of control for wide band dipole antenna with high directivity of shaped radiation pattern
[PB-206688] N72-25205
DIRECTIONAL CONTROL
Mathematical models for describing pilot performance during multiple input-output controller tasks
[NASA-CR-112048] N72-25128
DISCONNECT DEVICES
Gas operated quick disconnect coupling for umbilical connectors
[NASA-CASE-NPO-11202] N72-25450
DISEASES
Infrared radiometer and video scan system for remote sensing of root rot disease in Pacific Northwest Douglas fir tree population
[NASA-CR-126719] N72-25029
Decreased resistance to infections of respiratory system in closed ecological system
[NASA-CR-115641] N72-25061
DISORIENTATION
Proceedings of conference on medical aspects of spatial disorientation and effects on safe aircraft operation
[AGARD-CP-95-PT-1] N72-25031
Analysis of spatial disorientation reports by flying personnel during 14 year period
[NASA-CR-126786] N72-25032
Analysis of spatial disorientation occurrences among military pilots and classification according to types of aircraft and nature of accidents
N72-25033
Analysis of military aircraft accidents caused by spatial disorientation
N72-25034
Statistical analysis of military aircraft accidents to determine incidents caused by spatial disorientation
N72-25035
Psychophysiological and environmental factors involved in aircraft accidents of military aircraft and effect of flying experience in reducing spatial disorientation
N72-25036
Human centrifuge tests to determine aircraft pilot disorientation during aircraft catapult launchings
N72-25037
Contribution of reduced visibility and turbulence to loss of aircraft control and inadvertent aircraft maneuvers
N72-25041
Analysis of aircraft pilot reports on occurrence of unreality and detachment during flight and relationship to spatial disorientation
N72-25042
Development of procedures for exposing aviators to effects of spatial disorientation in ground based simulator
N72-25045
Application of methods of simulation of instrument flying as means of reducing occurrences of spatial disorientation in flight
N72-25046
Clinical evaluation and medical treatment of spatial disorientation problems in flying personnel
N72-25047
DISPLACEMENT MEASUREMENT
Linear displacement actuator including switching circuit and laser interferometer gage
N72-25804
DISPLAY DEVICES
Human factors engineering applied to development of radar symbology and discrimination in mixed displays for cathode ray tube presentation
[AD-738132] N72-25204
Data acquisition for spacecraft control noting data display techniques at ESOC
N72-25237
Computerized design of printed circuits using graphical display device in conversational mode
[FP/LP-DR5-1.501/71] N72-25243
Digital video system for displaying image and alphanumeric data on cathode ray tube
[NASA-CASE-NPO-11342] N72-25248
Display design for guidance and control
[AGARD-AR-43] N72-25419
Development of apparatus for mounting scientific experiments in spacecraft to permit utilization without maneuvering spacecraft
[NASA-CASE-MSC-12372-1] N72-25842
DISTANCE MEASURING EQUIPMENT
Binary coded sequential acquisition ranging system for distance measurements
[NASA-CASE-NPO-11194] N72-25209
Requirements for channel splitting to accommodate increased VHF omnirange navigation instrument landing systems, and distance measuring equipment facilities
[PAPER-54-71/SC122-3] N72-25602
DISTORTION
Thermal distortion and static bending plus twist measurements on deployable boom structures for spacecraft
N72-25789
DIURNAL VARIATIONS
Solar activity variation of ionospheric ion composition and variation of NO(plus)/O(plus) ratio during day in E and F regions
[RSD-67] N72-25719
DIVING (UNDERWATER)
Aqualung swimmers, using air and normoxic mixtures of argon and helium for breathing
[NASA-TT-F-14260] N72-25030
Occurrences of vertigo in hyperbaric atmospheres and among underwater divers with theoretical explanations of etiology involved
N72-25043
Visual evoked response as measure of nitrogen narcosis in divers breathing compressed air from 0 to 250 feet
[AD-737208] N72-25114
Diver performance in manual and mental tasks at 66 feet
[AD-737376] N72-25116
DOLPHINS
Operational characteristics of dolphin hydrolocator system
N72-25107
DOPPLER EFFECT
Application of Doppler effect and artificial satellite coverage for tracking wild animals
N72-25063
Development and characteristics of laser Doppler velocity instrument to measure velocities of flowing fluids
N72-25505
Development and characteristics of dual scatter laser Doppler velocimeter for flow distribution measurement in wind tunnels, helicopter downwash, and across high lift wing sections
N72-25506
Carrier tracking loop for phase lock micrometer laser receiver
N72-25771
DOPPLER RADAR
Applying Doppler techniques to studying atmospheric phenomena
N72-25364
Application of Doppler radar to meteorological problems
N72-25365
Comments on high power, high resolution radars
N72-25366
DOSIMETERS
Factors affecting design of albedo-neutron dosimeters, using Li-6 and Li-7 thermoluminescent dosimetry systems
[LA-4832] N72-25442
DRAWINGS
Transmitter subsystem drawings for DC/EC digital test system
[NASA-CR-115597] N72-25230
Assembly drawings of receiver unit for data compression/error correction digital test system
[NASA-CR-115607] N72-25232
DROPS (LIQUIDS)
Method of measuring mist droplets by size and number
[RAE-LIB-TRANS-1627] N72-25302
Solidification time of metal drops in vacuum, considering heat removal by radiation and evaporation
[RM-544] N72-25532

DUCTED FLOW
Prediction method for subsonic flow of inviscid fluid through duct of arbitrary cross section N72-25294

DUMPING
Development of electric circuit for suppressing parasitic oscillations across inductor operating in resonant mode
[NASA-CASE-ERC-10403-1] N72-25280

DUST
Annual variations of upper atmospheric sodium abundance based on dust particle temperature N72-25396

DWARF STARS
Equivalent widths of line spectra for late F dwarfs
[BULL-167] N72-25745

DYES
Infrared tunable laser with wavelength-selective reflectors, lasable dye solutions, and nonlinear mixing crystal
[NASA-CASE-ARC-10463-1] N72-25268

DYNAMIC CHARACTERISTICS
Orbital stability of Radio Astronomy Explorer satellite having four antenna booms N72-25759

DYNAMIC LOADS
Development and characteristics of device for indicating and recording magnitude of force applied in axial direction
[NASA-CASE-MSC-15626-1] N72-25411
Inelastic behavior of metals subjected to various types of loads
[AD-738326] N72-25538
Galerkin stability analysis on critical loads of polygenic systems using Kelvin model and external damping
[REPT-102] N72-25890

DYNAMIC MODELS
Developmental model of instrumentation record/reproduce system N72-25799

DYNAMIC STRUCTURAL ANALYSIS
Finite element method in dynamic structural analysis on axisymmetric vibrating cylinders
[REPT-106] N72-25884

E

E REGION
Positive ion composition and metallic ion layer in equatorial E region
[NASA-TM-X-65891] N72-25341

EARPHONES
Effects of sonar headset echo ranging on hearing effects in sonar technicians
[AD-737207] N72-25113

EARTH ATMOSPHERE
Method to derive statistical characterizations of perturbations imposed upon wave propagating through random medium such as earth atmosphere N72-25349
Remote sensing of optical effects arising from refractive index variations of clear atmosphere by ground-to-ground line-of-sight optical methods N72-25352
Atmospheric propagation of sound waves at infrasonic frequencies N72-25385
Present and past compositions and evolution of Earth, Venus, Mars, and Jupiter atmospheres N72-25822
Amended bill establishing National Advisory Committee on Oceans and Atmosphere
[S-REPT-92-333] N72-25947

EARTH ENVIRONMENT
Optical measurements of magnitude of scintillation as function of range and refractive index structure coefficient in near earth environment N72-25354

EARTH ORBITAL RENDEZVOUS
Strategy and logic used in space shuttle on-orbit rendezvous target program, for circular orbits
[NASA-CR-123713] N72-25836

EARTH ORBITS
Dynamic equations of earth-moon system integrated back in time to study early orbit and origin of moon N72-25823

EARTH RESOURCES
Design and operation of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements
[NASA-CR-126721] N72-25334
Breadboard tests of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements
[NASA-CR-126722] N72-25335
Use of acoustic waves for remote probing of lower atmosphere N72-25384
Briefings on energy sources, resources, and research N72-25929

EARTH RESOURCES PROGRAM
Design of multispectral infrared line scanner for use on space shuttle earth resources mission, noting equipment specifications
[REPT-779/72/1-VOL-1] N72-25445
Design of multispectral infrared line scanner for use on a space shuttle earth resources mission
[REPT-779/72/1-VOL-2-SUMM] N72-25446

EARTH SATELLITES
Atmospheric absorption measurements for meteorological research using microwave transmissions from satellite beacons N72-25351

EARTH-MOON SYSTEM
Dynamic equations of earth-moon system integrated back in time to study early orbit and origin of moon N72-25823

ECCENTRICITY
Eccentricity perturbation prediction for lunar orbit of Radio Astronomy Explorer satellite N72-25758

ECONOMY
Readings on science, technology, and economy, and presidential economic policy N72-25942

EDUCATION
Technological approaches to education N72-25941

EIGENVALUES
Sequence of FORTRAN subroutines for conversion of eigenvalue problem into standard form
[REPT-18] N72-25557
Limits for lowest eigenvalues in problems containing an alpha parameter
[DISS-4727] N72-25569
Multiple eigenvalue analysis on structural vibrations of linear systems with estimation of frequency boundary stability
[REPT-43] N72-25881
Eigenvalue curves for rods vibrating under buckling loads
[REPT-107] N72-25883

ELASTIC BUCKLING
Eigenvalue curves for rods vibrating under buckling loads
[REPT-107] N72-25883

ELASTIC MEDIA
Maxwell stress function solution for three dimensional elasticity problem
[REPT-79] N72-25888

ELASTIC PROPERTIES
Critical shear stress of alkali halides containing non-agglomerated and agglomerated elastic dipoles
[NRC-TT-1544] N72-25166
Inelastic behavior of metals subjected to various types of loads
[AD-738326] N72-25538
Elastic-plastic deformation analysis of plane frames using linear programming
[REPT-88] N72-25896
Theoretical elastic analysis for in-plane shear of corrugated plate with curvilinear corrugations and with discrete attachments between ends of corrugations and surrounding members
[NASA-CR-2080] N72-25902

ELASTIC SYSTEMS
Galerkin stability analysis on critical loads of polygenic systems using Kelvin model and external damping
[REPT-102] N72-25890

ELASTOMERS
Marine biocidal properties of elastomer compounds and sea water exposure tests
[REPT-496] N72-25550

ELECTRIC ARCS
Deflection of electric arc by asymmetrical heating using high frequency pulsed radiation
[ISL-29/71] N72-25282
Flow analysis in 1-MJ electric arc shock tunnel at Mach 7 to 19
[NASA-TN-D-6865] N72-25290
Arc formation time, field emission, and impact of charged microparticles
[CERN-71-28] N72-25634

ELECTRIC BATTERIES
Development of device for simulating charge and discharge cycle of battery in synchronous orbit
[NASA-CASE-GSC-11211-1] N72-25020
Design and fabrication of mercuric oxide-cadmium batteries to provide increased shelf life and low temperature operating capability
[AD-736769] N72-25028

ELECTRIC CONDUCTORS
Development of process for forming insulating layer between two electrical conductor or semiconductor materials
[NASA-CASE-LEW-10489-1] N72-25447

ELECTRIC CONNECTORS
Development of electric connector and pin assembly with radio frequency absorbing sleeve to reduce radio frequency interference
[NASA-CASE-XLA-02609] N72-25256
Gold embrittlement in flight connector soldered joints
[JPL-TM-33-533] N72-25522

ELECTRIC CONTROL
Fault tree analysis on safety of reactor electrical control system N72-25981

ELECTRIC CURRENT
Load current sensor for series pulse width modulated power supply
[NASA-CASE-GSC-10656-1] N72-25249
Electric current production in magnetosphere and energy transfer from solar wind to magnetosphere
[NASA-TM-X-65893] N72-25340

ELECTRIC DISCHARGES
Damage due to local internal electric discharges in insulating polymeric materials N72-25552

ELECTRIC EQUIPMENT
Development of procedure for precise measurement of dielectric loss based on frequency measurement
[TN-174] N72-25278

ELECTRIC FIELD STRENGTH
Lack of dependence of low frequency, sky wave field strength variations during nighttime on solar activity in Europe
[BBC-1972/12] N72-25731

ELECTRIC FIELDS
Measurement of electric fields, magnetic fields, and charged particles in auroral band using Nike-Tomahawk rocket vehicle N72-25326
Measurement of vector ion transport velocities in F region based on line of sight plasma motion and Doppler shift of returned incoherent scatter spectrum N72-25328
Effect of current and ion sound instability on plasma electrical conductivity in strong electric fields
[LA-TR-71-79] N72-25673
Barium cloud tracking and floating potential measurement for magnetospheric electric fields
[NASA-TM-X-65895] N72-25829

ELECTRIC FILTERS
Development of electric connector and pin assembly with radio frequency absorbing sleeve to reduce radio frequency interference
[NASA-CASE-XLA-02609] N72-25256

ELECTRIC GENERATORS
Inductive-capacitive loops as load insensitive power converters
[NASA-CASE-ERC-10268] N72-25252
Dc to ac to dc converter with transistor driven synchronous rectifiers
[NASA-CASE-GSC-11126-1] N72-25253

ELECTRIC MOTORS
Speed control system for dc motor equipped with brushless Hall effect device
[NASA-CASE-MFS-20207-1] N72-25267
Thick film circuitry for brushless motor commutator and control N72-25766

ELECTRIC POTENTIAL
Electron energy plasma ion density, and electric potential in simulated thermionic energy converter
[NASA-CR-126866] N72-25668
Electric potential distribution along ion beam with application to Penning discharge
[TRITA-EPP-71-26] N72-25674
Barium cloud tracking and floating potential measurement for magnetospheric electric fields
[NASA-TM-X-65895] N72-25829

ELECTRIC POWER
APU for providing hydraulic and electric power to space shuttle booster and orbiter
[NASA-CR-1994] N72-25024

ELECTRIC POWER SUPPLIES
Development of electric circuit for suppressing parasitic oscillations across inductor operating in resonant mode
[NASA-CASE-ERC-10403-1] N72-25280

ELECTRIC PROPULSION
Analysis of requirements for thermionic reactor electric propulsion system
[NASA-CR-126867] N72-25704

ELECTRIC SWITCHES
Computer programming for regulation of switchgear demands N72-25226

ELECTRIC TERMINALS
Development of electric connector and pin assembly with radio frequency absorbing sleeve to reduce radio frequency interference
[NASA-CASE-XLA-02609] N72-25256

ELECTRIC WIRE
Lead attachment for high temperature operation of electronic devices
[NASA-CASE-ERC-10224] N72-25261

ELECTRICAL ENGINEERING
Research by School of Engineering during 1971 at Purdue University N72-25263

ELECTRICAL INSULATION
Development of process for forming insulating layer between two electrical conductor or semiconductor materials
[NASA-CASE-LEW-10489-1] N72-25447

ELECTRICAL PROPERTIES
Design and fabrication of mercuric oxide-cadmium batteries to provide increased shelf life and low temperature operating capability
[AD-736769] N72-25028
Circuitry and electrical performance of solid state Ku band IMPATT diode amplifier
[NASA-CR-122426] N72-25270
Proceedings of conference on electrodeposited materials to describe properties and applications
[AD-738272] N72-25536
Ac susceptibility, dc magnetization, and specific heat capacity methods for measuring superconducting properties of fast frozen In-Ga alloys
[TID-25864] N72-25694
ELECTRICAL RESISTIVITY
Electrically conductive fluorocarbon polymers
[NASA-CASE-XLE-6774-2] N72-25150
Development of theory for interfacial thermal conductance between two heated metal plates in direct contact
[NASA-CR-126743] N72-25921
ELECTROCARDIOGRAPHY
Long term ECG examinations of pilots using tests at rest and master tests
N72-25050
One-channel portable tape recording system for long term ECG recording of flying personnel
N72-25051
Automatic analysis of ECG at rest, during and after exercise with two computer systems
N72-25052
Analog computer program for analysis of extended electrocardiographic monitoring
N72-25053
Method and criterion for evaluating ELF magnetic field interference effects on cardiac pacemaker function
[AD-737237] N72-25111
ELECTROCHEMICAL MACHINING
Electrochemical machining of beryllium
[AD-738271] N72-25483
ELECTROCHEMISTRY
Anodic and cathodic passivation of aluminum electrode in AlCl3-KCl-NaCl melts between 100 and 160 C
[NASA-CR-126727] N72-25153
ELECTRODEPOSITION
Proceedings of conference on electrodeposited materials to describe properties and applications
[AD-738272] N72-25536
ELECTRODES
Manufacturing process for making prespiration resistant-stress resistant biopotential electrode
[NASA-CASE-MSC-90153-2] N72-25120
Dry electrode manufacture, using silver powder with cement
[NASA-CASE-FRC-10029-2] N72-25121
Weight screening method for optimum selection of nickel and cadmium cell plates
N72-25768
ELECTROLYTES
Design and fabrication of mercuric oxide-cadmium batteries to provide increased shelf life and low temperature operating capability
[AD-736769] N72-25028
Solid electrolyte oxygen regeneration system with electrolyzer, carbon deposition reactor, and palladium membranes for separating hydrogen
[NASA-CR-2014] N72-25125
ELECTROMAGNETIC FIELDS
Improved orientation characteristics of quantum magnetometer with joint operation of radio frequency field and modulated optical pumping
N72-25436
ELECTROMAGNETIC INTERFERENCE
Method and criterion for evaluating ELF magnetic field interference effects on cardiac pacemaker function
[AD-737237] N72-25111
Sideband modulating technique for generating UHF signals used in laboratory interference tests
[BBC-1972/15] N72-25416
Quantum interference fluxmeter with superconducting sensor having circuit loop with sharp constrictions, for measuring weak magnetic fields
N72-25431
ELECTROMAGNETIC NOISE
Development of idler feedback system to reduce electronic noise problem in two parametric amplifiers
[NASA-CASE-LAR-10253-1] N72-25258
Geomagnetic tail noise caused by electron instability in neutral sheet
[AD-738316] N72-25398
ELECTROMECHANICAL DEVICES
Electromechanical actuator for producing mechanical force and/or motion in response to electrical signals
[NASA-CASE-NPO-11738-1] N72-25269
ELECTROMYOGRAPHY
Clinical electrodiagnosis in prognosis of lower motor neuron lesions
N72-25058
ELECTRON BEAM WELDING
Role of hydrogen in formation of massive voids during electron beam welding of titanium and effect of various treatments on hydrogen contamination and elimination
[RM-545] N72-25481
ELECTRON DENSITY [CONCENTRATION]
Measurement of currents associated with quiet auroral arc using vector magnetometer and lunar aspect sensor
N72-25324
D region electron density profiles from differential phase partial reflection measurements
[NASA-CR-126725] N72-25329
Faraday fading data from Explorer 27 and electron content values
[RSD-66] N72-25331
Electron density profiles and models for flare time D region densities
[RSD-68] N72-25718
ELECTRON DIFFUSION
IMP 4 data on coronal transport of flare associated scatter-free electron events and two-dimensional diffusion model
[NASA-TM-X-65887] N72-25724
ELECTRON ENERGY
Electron energy plasma ion density, and electric potential in simulated thermionic energy converter
[NASA-CR-126866] N72-25668
Solar wind model having electrons and protons at same temperature near sun and proton thermal anisotropy beyond 0.4 AU
N72-25720
Galactic ionized hydrogen regions and electron temperatures
[REPT-98] N72-25750
ELECTRON GAS
Approximation method for quantum correction to kinetic energy function of decaying electron gas density and potential distribution
N72-25650
ELECTRON IRRADIATION
Mathematical model for magnesium fluoride degradation due to electron irradiation
[ONERA-DERTS-NT-02-29] N72-25553
ELECTRON MICROSCOPES
Electron microscopic examination of dislocation structure in alternately stressed austenitic steels
[NASA-TT-F-14267] N72-25521
Scanning electron microscope for detection of metallization defects in semiconductor devices
N72-25803
ELECTRON PARAMAGNETIC RESONANCE
Spectrometer with superheterodyne receiver for high resolution electron paramagnetic and molecular rotation-spectroscopy
[DISS-4673] N72-25272
Hyperfine structure in crystal calcium tungstate determined by combination of electron paramagnetic resonance and electron nuclear double resonance techniques
[NASA-CR-126751] N72-25683
ELECTRON PHONON INTERACTIONS
Band model calculation for electron phonon coupling in intermetallic A15 compounds
N72-25644
ELECTRON PRECIPITATION
Effects of substorm activity, interplanetary magnetic field latitude, and dipole tilt angle on high-latitude precipitation of 700-eV electrons, determined from OGO 4 data
[NASA-TM-X-65902] N72-25832
ELECTRONIC EQUIPMENT
Performance tests of acoustic radar equipment to detect vortices formed by low flying aircraft and comparison with conventional sensing methods
[FAA-RD-71-103] N72-25008
Development and application of instrumentation for tracking movements of sea turtles and polar bears
N72-25064
Characteristics of biological telemetry systems and application in various areas of investigation with criteria for evaluation of systems
[JPRS-55354] N72-25189
Development of miniature electronic transmitters and application for monitoring biological and physiological activities
[NASA-CR-127047] N72-25191
Lead attachment for high temperature operation of electronic devices
[NASA-CASE-ERC-10224] N72-25261
Development of method and apparatus for detecting surface ions on silicon diodes and transistors
[NASA-CASE-ERC-10325] N72-25457
Ion implanter characteristics for electronic component design
[CEA-CONF-1871] N72-25656
Development and characteristics of electronic diagnostic system for analysis of plasma medium
[AD-738306] N72-25677
ELECTRONIC MODULES
Telemetry remote module for data transmission to central control core
N72-25775
ELECTRONS
Geomagnetic tail noise caused by electron instability in neutral sheet
[AD-738316] N72-25398
Ground state properties of electron gas at metallic densities
[NUB-2126] N72-25629
Access of interplanetary protons and electrons to polar cap regions and geomagnetic tail configurations
[NASA-CR-122359] N72-25726
ELECTROPLATING
Strain gage data and techniques for D-38 test beams electroplated with nickel and gold
[UCRL-51169] N72-25443
ELECTROSTATIC PRECIPITATORS
Theory and operation of electrostatic precipitator plates for gas purification
[DISS-4608] N72-25279
ELECTROSTATIC PROBES
Development and characteristics of electronic diagnostic system for analysis of plasma medium
[AD-738306] N72-25677
ELEMENTARY PARTICLE INTERACTIONS
Elementary pion with transverse momentum cutoff and pion contribution to neutron spectra in high energy reactions
[NOTA-INTERNA-360] N72-25665
ELEMENTARY PARTICLES
Production of high purity radioiodine by bombardment of cesium heat pipe
[NASA-CASE-LEW-11390-1] N72-25645
ELEVATORS [LIFTS]
Guide member for stabilizing cable of open shaft elevator
[NASA-CASE-KSC-10513] N72-25453
ELLIPTIC FUNCTIONS
Holographic recording of hypersonic projectile in tunnels, including elliptical device and aberrations
[ISL-41/71] N72-25507
EMBRITTLEMENT
Gold embrittlement in flight connector soldered joints
[JPL-TM-33-533] N72-25522
EMERGENCY LIFE SUSTAINING SYSTEMS
Three transceiver lunar emergency system to relay voice communication of astronaut
[NASA-CASE-MFS-21042] N72-25171
EMISSION SPECTRA
Hartree-Fock identification of Kappa alpha satellites in light atoms
[CNRS-AO-4091] N72-25643
Statistical analysis of radiation intensity in emission spectroscopy
[EUR-4716] N72-25655
EMITTERS
Control, reproducibility, and predictability for annular colloid emitter
[NASA-CR-122385] N72-25710
ENERGY BUDGETS
Pulse modulated biotelemetry system for determining energy budgets in free-ranging vertebrates from heart rate and body temperature measurement
N72-25123
ENERGY DISSIPATION
Numerical analysis of radiant heat flux and local energy loss of line in region of strong variations of source function in one direction
[NASA-CR-126965] N72-25925
ENERGY DISTRIBUTION
Sea-air energy flux measurements from atmospheric budget, surface layer vertical eddy flux, and upper ocean heat budget data
[NOAA-TM-ERL-BOMAP-9] N72-25333
Approximation method for quantum correction to kinetic energy function of decaying electron gas density and potential distribution
N72-25650
ENERGY SOURCES
Indexes for research projects on energy sources
[ORNL-EIS-72-18-VOL-2] N72-25658
Briefings on energy sources, resources, and research
N72-25929
ENERGY SPECTRA
Table of gamma ray energies and intensities from radioactive isotopes produced by (n,gamma) reactions
[IRI-133-71-06] N72-25661
Temporal variations, energy spectrum, and directional properties of solar cosmic rays studied with Pioneer 8 and 9 data
N72-25716
ENERGY TRANSFER
Collisional energy transfer during vibrational excitation of HF and DF at high temperature and pressure
[AD-738296] N72-25168
Electric current production in magnetosphere and energy transfer from solar wind to magnetosphere
[NASA-TM-X-65893] N72-25340
Validity of energy criterion in predicting critical load stability of continuous system
[REPT-63] N72-25885
ENGINE PARTS
Purge system and components of HRE AIM
[NASA-CR-112060] N72-25715

ENVIRONMENT POLLUTION
Safety procedures for operating nuclear reactors
[NP-19199] N72-25614
ENVIRONMENT SIMULATION
Instrument landing system simulator including special signal generator for environment simulation
[RAE-TR-71145] N72-25607
ENVIRONMENTAL CONTROL
Environmental control/life support system for four-man, seven-day orbital shuttle
[NASA-CR-1981] N72-25126
ENVIRONMENTAL INDEX
Environmental and endogenous timing factors as stimuli for bird migration
N72-25082
ENVIRONMENTAL LABORATORIES
Social, economic, and physical impact of high energy physics accelerator laboratory on environment
[WASH-1505] N72-25291
EOLE SATELLITES
Data acquisition and processing using CDC computers at CNES noting Eole and D-2 programs
N72-25236
Eole monitoring of drifting buoys and balloons in Southern Hemisphere for oceanographic and meteorological data
[NASA-TT-F-14279] N72-25345
EPOXY COMPOUNDS
Synthesis of siloxane containing epoxide and diamine polymers
[NASA-CASE-MFS-13994-2] N72-25148
EPOXY RESINS
Tensile strength and creep properties of fiber/epoxy resin composites
[NASA-TM-X-68053] N72-25544
EQUATIONS OF MOTION
Transformation of motion equations in disturbed Kepler boundary problem of celestial mechanics
[DISS-4676] N72-25570
Development of theory for propagation of elastic-plastic waves in truncated conical shells
[AD-737100] N72-25910
Solution to nonlinear equations of motion for gas in solid propellant rocket engine
N72-25914
EQUILIBRIUM FLOW
Molecular relaxation equilibrium conditions behind reflected shock waves with tables for carbon dioxide and nitrous oxide
[ARC-CP-1201] N72-25316
EQUIPMENT SPECIFICATIONS
Design of multispectral infrared line scanner for use on space shuttle earth resources mission, noting equipment specifications
[REPT-779/72/1-VOL-1] N72-25445
Instruments and procedures for ultrasonic inspection of cast bronze bars
[REPT-7009.453] N72-25467
ERGOMETERS
Tilting table for testing human body in variety of positions while exercising on ergometer or other biomedical devices
[NASA-CASE-MFS-21010-1] N72-25127
ERROR ANALYSIS
Magnetometer designs for measuring weak and very weak magnetic fields, and error analyses
[JPRS-56099] N72-25430
Error analysis in measuring geomagnetic field components with self-oscillating quantum magnetometer with auxiliary alternating fields
N72-25433
Analysis of errors of quantum magnetometer in measuring inclination and declination
N72-25437
Cesium Z-magnetometer for marine geomagnetic measurements onboard nonmagnetic schooner, and error analysis
N72-25439
Ionospheric bias correction methods in radio tracking of spacecraft
N72-25756
ESRO SATELLITES
Data acquisition and processing systems for ESRO satellites, noting production control
N72-25241
ESSA 8 SATELLITE
European cloud reliefs constructed from ESSA 8 satellite observations during fall of 1971
[QR-3-PT-3] N72-25577
ESTUARIES
Water quality simulation model for well-mixed estuaries and coastal seas
[P-4772-1] N72-25332
EUROPE
Computation of gravimetric Eurasia, North Atlantic, and United States geoid from satellite and surface gravity derived data
[NASA-TM-X-65884] N72-25344
European cloud reliefs constructed from ESSA 8 satellite observations during fall of 1971
[QR-3-PT-3] N72-25577
EXERCISE [PHYSIOLOGY]
Tilting table for testing human body in variety of positions while exercising on ergometer or other biomedical devices
[NASA-CASE-MFS-21010-1] N72-25127
EXHAUST GASES
Analytical measurements of exhaust emissions from aircraft turbine engines using Jet A fuel
[BM-RI-7634] N72-25584
Actions of EPA for achieving 90 percent reduction of hydrocarbons in motor vehicle emissions by 1975
N72-25585
Analysis of emissions from aircraft piston and gas turbine engines - tables
[PB-207107] N72-25589
Checkout of multipoint sampling rake and exhaust emission of turbofan engines
[PB-207321] N72-25593
EXPERIMENTAL DESIGN
Proposed NASA experiment for spaceborne clock system to develop new atomic frequency standards technology and improve international time and frequency comparisons
[NASA-CR-122394] N72-25423
EXPERIMENTATION
Data processing requirements for experimenters with constraints on spacecraft telemetry, orbit, and attitude
N72-25238
EXPIRED AIR
Respiratory gas analyzer for aircrew pulmonary function measurements
[NASA-TM-X-68370] N72-25057
EXPLORER 27 SATELLITE
Faraday fading data from Explorer 27 and electron content values
[RSD-66] N72-25331
EXPLORER 33 SATELLITE
Data acquisition and processing for Explorer 33 satellite
[NASA-TM-X-65894] N72-25828
EXPLORER 34 SATELLITE
IMP 4 data on coronal transport of flare associated scatter-free electron events and two-dimensional diffusion model
[NASA-TM-X-65887] N72-25724
EXPLOSIVE DEVICES
Worst case failure analysis on explosive package for lunar seismology experiment
N72-25980
EXPLOSIVES
Detonation of secondary high explosives by Q switched ruby laser
[NASA-CR-126741] N72-25492
EXPONENTIAL FUNCTIONS
Approximation of N[h] profile by exponential functions for D region
N72-25389
EXTERNALLY BLOWN FLAPS
Review of work on external flow jet flaps noting lift coefficient
[ARC-CP-1194] N72-24998
EXTRAVEHICULAR ACTIVITY
Development of regenerable or partially regenerable life support systems use in EVA protective systems
[NASA-CR-114382] N72-25133
Postflight analysis of EVCS to LM communications link for Apollo 15 mission to verify performance prediction techniques
[NASA-TM-X-68426] N72-25183
EXTREMELY LOW FREQUENCIES
Method and criterion for evaluating ELF magnetic field interference effects on cardiac pacemaker function
[AD-737237] N72-25111
Characteristics of plane wave and localized disturbances affecting ultralow frequency and extremely low frequency propagation in ionosphere
N72-25178
EXTREMUM VALUES
Limits for lowest eigenvalues in problems containing an alpha parameter
[DISS-4727] N72-25569

F

F REGION
Measurement of vector ion transport velocities in F region based on line of sight plasma motion and Doppler shift of returned incoherent scatter spectrum
N72-25328
Ionospheric double layers in topside and F region, stability, and anomalous resistivity
[TRITA-EPP-72-07] N72-25395
FABRY-PEROT INTERFEROMETERS
Li-6/Li-7 ratio for F, G, and early K field stars determined theoretically and with Fabry-Perot interferometer
N72-25735
FAIL-SAFE SYSTEMS
Fail-safe multiple transformer circuit configuration
[NASA-CASE-NPO-11078] N72-25262
Fatigue assessment of safe life and fail-safe structures
[ARL/SM-REPT-334] N72-25899
FAILURE ANALYSIS
Failure of parachute on Apollo 15 spacecraft during earth landing
[NASA-TM-X-68350] N72-25848
Deformation behavior of saturated sand in triaxial compression and extension tests
[REPT-60] N72-25880
Applicability of NASA contract quality management and failure mode effect analysis procedures to USGS Outer Continental Shelf oil and gas lease management program
[NASA-TM-X-2567] N72-25955
Factors causing system safety programs to fail
N72-25966
Fault tree analysis on safety of reactor electrical control system
N72-25981
FALLING SPHERES
Drag coefficients in falling sphere technique for atmospheric density sensing
[NASA-CR-126742] N72-24995
FAR INFRARED RADIATION
Far infrared sources in galactic H II regions, and possible relation to thermal radio sources and interstellar dust
N72-25737
FARADAY EFFECT
Faraday fading data from Explorer 27 and electron content values
[RSD-66] N72-25331
FATIGUE (MATERIALS)
Development of computer program for cyclic deformation and fatigue properties of materials under axial and flexural conditions
[TN-4] N72-25892
FATIGUE LIFE
Fatigue assessment of safe life and fail-safe structures
[ARL/SM-REPT-334] N72-25899
FATIGUE TESTS
Effects of creep and low cycle fatigue tests on alpha iron grain boundaries at 450 to 700 C
[TN-10] N72-25512
Development of computer program for cyclic deformation and fatigue properties of materials under axial and flexural conditions
[TN-4] N72-25892
FEASIBILITY
Feasibility evaluation of oligatomic computer storage device
[NASA-CR-123533] N72-25214
FEDERAL BUDGETS
NASA budget authorization for 1973
[S-REPT-92-779] N72-25933
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 1
N72-25936
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 2
N72-25937
Appropriations for NASA manned space flight program during 1973
N72-25938
Hearings before House Committee on budget requests for military construction and family housing
N72-25943
Hearings before House Committee on budget requests for Army, Safeguard, and Defense Agencies construction
N72-25944
Federal funds for research and development for FY 1970, 71, and 72
[NSF-71-35-VOL-20] N72-25956
FEEDBACK
Inverter oscillator with voltage feedback
[NASA-CASE-NPO-10760] N72-25254
FEEDBACK CIRCUITS
Development of idler feedback system to reduce electronic noise problem in two parametric amplifiers
[NASA-CASE-LAR-10253-1] N72-25258
FEEDBACK CONTROL
Alternative schemes for providing closed loop reactor control in thermionic reactor systems
[NASA-CR-126868] N72-25610
FELDSPARS
Lunar cratering, nature of Apollo 11 soils, and geological implications of anothosite fragments in soil
N72-25820
FIBERS
Thermal aspects of using filamentary composite materials for airframes on atmospheric entry spacecraft
[SD-72-SH-0015] N72-25542
Tensile strength and creep properties of fiber/epoxy resin composites
[NASA-TM-X-68053] N72-25544

FIELD EFFECT TRANSISTORS
Computer aided two dimensional analysis of silicon metal Schottky gate field effect transistor transport equation
[DISS-4661] N72-25271
Thick film field effect transistor circuits for space flight data processing system
N72-25774

FIELD EMISSION
Arc formation time, field emission, and impact of charged microparticles
[CERN-71-28] N72-25634

FIELD THEORY [PHYSICS]
Approximation method for quantum correction to kinetic energy function of decaying electron gas density and potential distribution
N72-25650
Residual field theory for superconducting dipoles and quadrupole magnets
[KFK-EXT-3/71-10] N72-25695

FILLERS
Metallurgical evaluations of strength in TIG welded metal filled aluminum alloy 2219-T87
[NASA-TM-X-64659] N72-25474

FILM CONDENSATION
Effects of Gibbsian adsorbed layers and insoluble films on film forming mechanism of liquid mercury surfaces
[NASA-CR-120884] N72-25158

FINE STRUCTURE
Table of multiplet wavelengths and finding list of lines, for astrophysicists
[NSRDS-NBS-40] N72-25807

FINITE DIFFERENCE THEORY
Finite difference schemes for solving linear dynamic plate and shell equations
N72-25878

FINITE ELEMENT METHOD
Development of finite difference turbulent boundary layer computer program with consideration of mass transfer wall cooling and equilibrium chemistry effects
[NASA-CR-126728] N72-25301
Small displacement, strain, finite element technique, using constant strain triangle for gravity flow of powder
[BM-RI-7577] N72-25473
Thermal finite element computer program for variance analysis on predicted temperature field
N72-25764
Finite element method in dynamic structural analysis on axisymmetric vibrating cylinders
[REPT-106] N72-25884
Finite element for linear static stress analysis of thin elastic shells
[NRC-12624] N72-25900

FIRE PREVENTION
Hydrogen fire blink detector for high altitude rocket or ground installation
[NASA-CASE-MFS-15063] N72-25412

FISHES
Use of sunlight as underwater visual direction finder by fishes
N72-25089
Effect of chemical stimuli on orientation behavior of fish
N72-25090

FLAME PROPAGATION
Analysis of powder residue following one dimensional combustion and dependence on initial temperature and pressure
N72-25926

FLAMMABILITY
Development of apparatus for testing burning rate and flammability of materials
[NASA-CASE-XMS-09690] N72-25913

FLARED BODIES
Measurement of base pressure fluctuations at subsonic and supersonic speeds on flared bodies with flat or hemispherical noses
[ARC-CP-1204] N72-24997

FLAT PLATES
Iterative plate solution for flat shells in bending mode
[REPT-67] N72-25887

FLEXIBLE BODIES
Development of device for simulating cyclic thermal loading of flexible materials by application of mechanical stresses and deformations
[NASA-CASE-LAR-10270-1] N72-25877

FLIGHT CHARACTERISTICS
Statistical analysis of mission profiles for passenger- and cargo-transport aircrafts
[TB-88] N72-25002

FLIGHT CONTROL
Contribution of reduced visibility and turbulence to loss of aircraft control and inadvertent aircraft maneuvers
N72-25041
Application of methods of simulation of instrument flying as means of reducing occurrences of spatial disorientation in flight
N72-25046
Display design for guidance and control
[AGARD-AR-43] N72-25419

FLIGHT CREWS
Development of standardized method for evaluating physical geometry of aircrew stations - Vol. 1
[AD-738006] N72-25015
Computer programs for improved methods for evaluating physical compatibility of crew members with crew stations - Vol. 3
[AD-738007] N72-25016
Development of mathematical model for evaluating compatibility of flight crew personnel and aircraft crew stations - Vol. 4
[AD-738008] N72-25017
Validation of man-model joint movement parameters to determine compatibility of flight crews and aircraft compartments - Vol. 5
[AD-738009] N72-25018
Aeromedical requirements and examination techniques for aircrews - conference
[AGARD-CP-95-PT-2] N72-25048
Raised arterial blood pressure levels in aircrew members
N72-25054
Respiratory gas analyzer for aircrew pulmonary function measurements
[NASA-TM-X-68370] N72-25057

FLIGHT HAZARDS
Aircraft accident report concerning DC-9 aircraft contact with ocean surface and subsequent emergency landing at Martha's Vineyard, Massachusetts, June 22, 1971
[PB-207101] N72-25013
Analysis of spatial disorientation occurrences among military pilots and classification according to types of aircraft and nature of accidents
N72-25033

FLIGHT SAFETY
Analysis of US general aviation aircraft accidents for calendar year 1969
N72-25003
Educational programs for improvement and management of flight system safety
N72-25970

FLIGHT SIMULATION
Application of methods of simulation of instrument flying as means of reducing occurrences of spatial disorientation in flight
N72-25046
Pilot tracking performance during in-flight simulated instrument approaches with single engine general aviation aircraft
[FAA-AM-72-9] N72-25130

FLIGHT SIMULATORS
Fixed base simulator study of direct lift control on VC-10 aircraft
[ARC-CP-1199] N72-25010

FLIGHT TESTS
Applications of computers for flight test and evaluation of helicopters based on frequency analyses of load curves on main and tail rotors
[NASA-TT-F-14283] N72-24993
Flight tests of EC-130E aircraft with X band radome installed
[ENEA-71-45] N72-25007
Flight tests of Apollo spacecraft communications systems
[NASA-TN-D-6852] N72-25186

FLIGHT TRAINING
Medical elimination of students undergoing primary flight training
N72-25049

FLOW DISTORTION
Unsteady response of turbocompressor with inlet flow distorted by square wave and triangular spoilers
[ARC-CP-1203] N72-25000

FLOW DISTRIBUTION
Supersonic jet flow distribution from convergent nozzles
[ARC-CP-1197] N72-25315
Analysis of leading edge flow separation resulting from airfoils oscillating in uniform flow field at low Reynolds numbers
[AD-738304] N72-25320
Effect of disturbances produced by vibrating ribbon on accelerated laminar boundary layer at low Reynolds numbers
[AD-738335] N72-25321
Aerothermodynamic integration model, including combustor design, flow distribution, and heat transfer problems
[NASA-CR-112058] N72-25713

FLOW GEOMETRY
Measurement of gas flows in far upstream region of small nozzles with large boundary layer flow
[NASA-CR-126967] N72-25309

FLOW MEASUREMENT
Measurement of gas flows in far upstream region of small nozzles with large boundary layer flow
[NASA-CR-126967] N72-25309
Main methods of fuel flow measurement and factors for consideration in deciding on type of meter to use for various requirements
[AGARDOGRAPH-160-VOL-3] N72-25420
Application of laser beams for measurement of aerodynamic flow fields at supersonic and hypersonic speeds
N72-25503
Development and characteristics of laser Doppler velocity instrument to measure velocities of flowing fluids
N72-25505
Development and characteristics of dual scatter laser Doppler velocimeter for flow distribution measurement in wind tunnels, helicopter downwash, and across high lift wing sections
N72-25506

FLOW VISUALIZATION
Application of aerodynamic holography for optical recording and flow visualization in wind tunnels and research facilities
N72-25498

FLUID DYNAMICS
Thermal instability in differentially heated inclined fluid layers and unstable base flow in conduction regime
[REPT-44] N72-25299
Evolution of solar rotation rate, solar fluid dynamics, braking, spin-down, and effects of instabilities
N72-25813

FLUID FLOW
Application of polymers for reduction of pipe flow drag in commercial water supplies and effect of temperature on polymer effectiveness
[AD-738255] N72-25319
Development and characteristics of laser Doppler velocity instrument to measure velocities of flowing fluids
N72-25505

FLUID TRANSMISSION LINES
Device for suppressing pressure oscillations in fluid transmission line
[NASA-CASE-MFS-10354-2] N72-25306

FLUIDIZED BED PROCESSORS
Design and experimental performance of rotating fluidized bed reactor for use in nuclear propulsion systems
[NASA-CR-126738] N72-25611

FLUOROCARBONS
Electrically conductive fluorocarbon polymers
[NASA-CASE-XLE-6774-2] N72-25150

FLUOROSCOPY
Analysis of nonradiative transitions in Xanthine coloring matter by flash photolysis and spectrofluorometry
N72-25155

FLUTTER
Dynamic theory of flutter for rotation of rigid wing
[ARL/SM-332] N72-24996
Variational method for calculating flutter load stability of column
[REPT-105] N72-25882
Development of Liapunov functional for continuous, nonconservative systems with damping
[REPT-66] N72-25886

FLYING PERSONNEL
Development of procedures for exposing aviators to effects of spatial disorientation in ground based simulator
N72-25045
Clinical evaluation and medical treatment of spatial disorientation problems in flying personnel
N72-25047
One-channel portable tape recording system for long term ECG recording of flying personnel
N72-25051
Aptitude for recovery from vertigo in flying personnel
N72-25059

FOG
Equipment and polyhydric chemicals for dispersing fog - Foggy Cloud 4 Project
[TOPR-178-1-121] N72-25154

FOLDING STRUCTURES
Apparatus and method of assembling building blocks by folding pre-cut flat sheets of material during on-site construction
[NASA-CASE-MSC-12233-1] N72-25454

FOOD
Radioactive waste management and wholesomeness of irradiated foodstuffs
[TID-25940] N72-25617

FORCE
Electromechanical actuator for producing mechanical force and/or motion in response to electrical signals
[NASA-CASE-NPO-11738-1] N72-25269

FORCE DISTRIBUTION
Development and characteristics of device for indicating and recording magnitude of force applied in axial direction
[NASA-CASE-MSC-15626-1] N72-25411

FORCED CONVECTION
Feasibility of forced convection ignition tests on cartridge powder
[TL-1971-16] N72-25919

FORECASTING
Statistical method for objectively producing forecasts of daily maximum temperatures from numerical model output
[NOAA-TM-NWS-TDL-45] N72-25581

FORESTS
Bibliography on use of remote sensing in forestry, agriculture, and plant ecology
N72-25327

FORMALDEHYDE
Formaldehyde emission and H2CO absorption in Orion nebula
[NASA-TM-X-65897] N72-25342

FOURIER SERIES
Fourier series for field structure of electromagnetic waveguide and mechanism in dissipative medium
[AD-737849] N72-25199

FOURIER TRANSFORMATION
Optical diffraction for two-dimensional Fourier amplitude transformation in study of rock fabrics and deformation
[AD-737390] N72-25408

FRACTURE MECHANICS
Effects of temperature, grain size, and strain rate on fracture behavior of Inconel alloy X-750
[TN-11] N72-25905

FRACTURE STRENGTH
Fracture control criteria applicable to space shuttle structures
[NASA-SP-8095] N72-25851

FRACTURES (MATERIALS)
Brittle fracture analysis of medium alloy steels for electroslag welded ship components
N72-25528

FRACTURING
Deformation and fracture of fine-grained alpha-beta brass
[REPT-92] N72-25515

FRAMES
Elastic-plastic deformation analysis of plane frames using linear programming
[REPT-88] N72-25896

FREE FLOW
Forced response of laminar boundary layers to free stream oscillations in oscillating flow wind tunnel
[AD-737856] N72-25318

FREE JETS
Mathematical model of impact between finite cylindrical free jet and rigid smooth wall
[PB-206912] N72-25322

FREE VIBRATION
Series solutions for free vibration of edge stiffened square plate
N72-25879

FRENCH SPACE PROGRAMS
Data acquisition and processing using CDC computers at CNES noting Eole and D-2 programs
N72-25236

FREQUENCY CONVERTERS
Development of family of frequency to amplitude converters for frequency analysis of complex input signal waveforms
[NASA-CASE-MSC-12395] N72-25257

FREQUENCY DIVISION MULTIPLEXING
System performance of FDM systems using subcarrier channel frequencies from 4 to 200 kHz and channel information bandwidths of dc to 1, 2, 4, 8 and 16 kHz
[NASA-CR-123580] N72-25275

FREQUENCY MEASUREMENT
Development of procedure for precise measurement of dielectric loss based on frequency measurement
[TN-174] N72-25278

FREQUENCY MODULATION
Analytical and empirical procedures for pre-emphasis determination of S band constant bandwidth FM/FM station
[NASA-TM-X-64648] N72-25182
Adaptive narrow band, frequency modulation, voice communication system
N72-25783
Threshold effects in FM TV and low cost community TV reception via satellite
N72-25785

FREQUENCY STANDARDS
Proposed NASA experiment for spaceborne clock system to develop new atomic frequency standards technology and improve international time and frequency comparisons
[NASA-CR-122394] N72-25423

FRICTION REDUCTION
Application of polymers for reduction of pipe flow drag in commercial water supplies and effect of temperature on polymer effectiveness
[AD-738255] N72-25319

FUEL CELLS
Modification of manually operated fuel-cell system to provide monitoring and control by digital computer
[NASA-TM-X-2575] N72-25025

FUEL FLOW
Main methods of fuel flow measurement and factors for consideration in deciding on type of meter to use for various requirements
[AGARDOGRAPH-160-VOL-3] N72-25420

FUNCTION GENERATORS
Integrated circuit tangent function generator
[NASA-CASE-MSC-13907-1] N72-25281

FUNCTION SPACE
Optimal control and functional differential equations with terminal conditons in function space
[NASA-CR-126769] N72-25558
Riemann functions and conformal mapping for construction of complex systems
[DISS-4707] N72-25565

FUNCTIONAL ANALYSIS
Optimal control and functional differential equations with terminal conditons in function space
[NASA-CR-126769] N72-25558

FURLABLE ANTENNAS
Development of large, furlable spacecraft antennas using conical main reflectors with two and four reflection configurations
[NASA-CR-126966] N72-25193

FURNACES
Evaluation of refractory materials for furnace cores operating under oxidizing conditions
[NASA-CR-122425] N72-25551

FUSION WELDING
Solid state welding of butt joint by fusion welding, surface cleaning, and heating in air
[NASA-CASE-LEW-11387-1] N72-25471

G

GALACTIC RADIATION
Spectra of modulated galactic cosmic rays in terms of Compton-Getting coefficient
[NASA-TM-X-65901] N72-25722

GALERKIN METHOD
Hybrid Galerkin equation derivation for nonself-adjoint boundary value problem
[REPT-82] N72-25556

GALLIUM ALLOYS
Ac susceptibility, dc magnetization, and specific heat capacity methods for measuring superconducting properties of fast frozen In-Ga alloys
[TID-25864] N72-25694

GAME THEORY
Probabilistic method for random regular tournaments
[P-4479] N72-25560

GAMMA RAYS
Development and characteristics of gamma ray spectrometer for measurement of intense radiation using Compton scattering effect
[NASA-CASE-MFS-21441-1] N72-25427
Table of gamma ray energies and intensities from radioactive isotopes produced by [n,gamma] reactions
[IRI-133-71-06] N72-25661

GANTRY CRANES
Design and characteristics of mechanically extended and telescoping boom on crane assembly
[NASA-CASE-NPO-11118] N72-25021

GAS ANALYSIS
Performance tests of lunar mass spectrometer designed to sample and measure gases in lunar atmosphere at surface
[NASA-CR-126772] N72-25429
Computer program for automatic determination of gases in environmental chamber during spacecraft testing
N72-25788

GAS CHROMATOGRAPHY
Gas chromatographic method for analyzing hydrogen deuterium mixtures
[NASA-CASE-NPO-11322] N72-25146
Ultraviolet chromatographic detector for quantitative and qualitative analysis of compounds
[NASA-CASE-HQN-10756-1] N72-25428

GAS DYNAMICS
Chemical mixing in gas laser systems
[NASA-CR-126718] N72-25488

GAS FLOW
Solution of Chaplygin equation for gas flow at high subsonic velocity
[NASA-TT-F-14254] N72-25303
Measurement of gas flows in far upstream region of small nozzles with large boundary layer flow
[NASA-CR-126967] N72-25309
Forced response of laminar boundary layers to free stream oscillations in oscillating flow wind tunnel
[AD-737856] N72-25318
Velocity of particulate matter in laminar and turbulent gas flow, and holographic techniques
[PB-206950] N72-25510
Numerical analysis of vibrations and stability of fluid filled shells and gas flowing through shells as viscous incompressible fluid
N72-25907

GAS GENERATORS
Gas operated quick disconnect coupling for umbilical connectors
[NASA-CASE-NPO-11202] N72-25450
Performance tests and evaluation of gas generating and charging equipment for handling gaseous and cryogenic materials
[AD-738120] N72-25484

GAS LASERS
Chemical mixing in gas laser systems
[NASA-CR-126718] N72-25488

GAS MIXTURES
Aqualung swimmers, using air and normoxic mixtures of argon and helium for breathing
[NASA-TT-F-14260] N72-25030
Gas chromatographic method for analyzing hydrogen deuterium mixtures
[NASA-CASE-NPO-11322] N72-25146
Methods for predicting B-12 values for binary gas mixtures containing alkanes
[NPL-DCS-14] N72-25167

GAS TUNGSTEN ARC WELDING
Metallurgical evaluations of strength in TIG welded metal filled aluminum alloy 2219-T87
[NASA-TM-X-64659] N72-25474

GAS TURBINE ENGINES
Analysis of emissions from aircraft piston and gas turbine engines - tables
[PB-207107] N72-25589

GAS TURBINES
Research for developing computer program for gas turbine combustor flow
[NASA-CR-126724] N72-25702

GASES
Theory and operation of electrostatic precipitator plates for gas purification
[DISS-4608] N72-25279
Ground state properties of electron gas at metallic densities
[NUB-2126] N72-25629
Gas cloud collisions as radiation sources for quasi-stellar objects
[NASA-CR-126723] N72-25742

GAUGE INVARIANCE
Gage invariance and on-shell extrapolation of pion electroproduction at threshold
[NOTA-INTERNA-354] N72-25663

GE 635 COMPUTER
Systems manual for GE 635 computer
[NASA-CR-126770] N72-25218

GENERAL AVIATION AIRCRAFT
Analysis of US general aviation aircraft accidents for calendar year 1969
N72-25003
Review of U.S. general aviation accidents for 1969
[NTSB-ARG-71-1] N72-25004
Computer program for predicting performance, noise, weight, and cost of general aviation aircraft propellers for 1980 time period
[NASA-CR-2066] N72-25005
Pilot tracking performance during in-flight simulated instrument approaches with single engine general aviation aircraft
[FAA-AM-72-9] N72-25130

GEODESY
Annotated bibliography of references to published and unpublished items of geologic literature
[AD-735775] N72-25407

GEODETIC SATELLITES
Geodetic satellite tracking and orbit computations for ISAGEX operations
[NASA-TM-X-65886] N72-25860

GEOIDS
Computation of gravimetric Eurasia, North Atlantic, and United States geoid from satellite and surface gravity derived data
[NASA-TM-X-65884] N72-25344

GEOLOGY
Annotated bibliography of references to published and unpublished items of geologic literature
[AD-735775] N72-25407

GEOMAGNETIC TAIL
Geomagnetic tail noise caused by electron instability in neutral sheet
[AD-738316] N72-25398
Access of interplanetary protons and electrons to polar cap regions and geomagnetic tail configurations
[NASA-CR-122359] N72-25726

GEOMAGNETISM
Aerospace environment requirements for spacecraft operations, including information on solar activity, geomagnetic field, radiation dosage, and star catalogs
N72-25239
Geomagnetic measurements in Spain for 1969
N72-25338
Geophysics and space data
[AD-738327] N72-25397
Electrical and mechanical adjustments of quantum magnetometers for geomagnetic component measurement
N72-25434
Approximate compensation in airborne magnetometry for changing inductive field of aircraft moving through varying geomagnetic field
N72-25435
Galactic cosmic ray intensity, sunspot number, 10.7 cm radio flux, and geomagnetism
[AD-737848] N72-25728

GEOPHYSICAL OBSERVATORIES
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Apr. - June 1971
N72-25390

Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Jul. - Sep. 1971 N72-25391

GEOPHYSICS
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 15 May 1972
[JPRS-55985] N72-25824
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 1 June 1972
[JPRS-56154] N72-25834

GEOPOTENTIAL
Quasi-objective method for deriving 500-mb geopotential heights with aid of satellite cloud observations
[NOAA-TR-NESS-55] N72-25583

GEOPOTENTIAL HEIGHT
Effects of earth gravity on synchronous orbit satellite altitude N72-25761

GEOS 1 SATELLITE
Parameter effects on short arc satellite survey adjustments and GEOS 1 minitrack observations
[NASA-TM-X-65896] N72-25830

GLASS
Apparatus for applying thin glass slides to solar cells
[NASA-CASE-NPO-10575] N72-25019

GLIDE LANDINGS
Automatic flare and decrab guidance and control system for space shuttles
[NASA-CR-114436] N72-25599

GLIDE PATHS
Evaluation of STOL modular instrument landing system
[FAA-NA-72-11] N72-25605

GLOBAL ATMOSPHERIC RESEARCH PROGRAM
Remote atmospheric probing approaches in infrared from satellites for Global Atmospheric Research Program N72-25377

GOLD
Strain gage data and techniques for D-38 test beams electroplated with nickel and gold
[UCRL-51169] N72-25443

GOVERNMENT/INDUSTRY RELATIONS
Papers presented at conference on system safety in government and industry
[NASA-TM-X-68369] N72-25961
Factors causing system safety programs to fail N72-25966

GOVERNMENTS
Organization, personnel, funding, and facilities of National Bureau of Standards N72-25940
FAA national policies on overall missions and criteria for major subsystems
[REPT-1000.27-APP-1] N72-25949
National aviation system plan 1973-1982, as joint industry-government program
[REPT-1000.27-APP-2] N72-25950

GRAIN BOUNDARIES
Effects of creep and low cycle fatigue tests on alpha iron grain boundaries at 450 to 700 C
[TN-10] N72-25512
Influence of grain size and precipitate distribution on cre ρ behavior of copper base alloy
[TN-12] N72-25513
Microstructure of superplastic micrograin aluminum bronze
[REPT-93] N72-25514
Effect of grain boundary increase and intragrain defects in austenite structure on carbon diffusion
[NASA-TT-F-14272] N72-25516

GRAPHS [CHARTS]
Logistics curves used for describing scientific, shipping, and population versus time relations N72-25141

GRAVIMETERS
Influence of tilts and accelerations affecting gravimeter
[AD-737110] N72-25399

GRAVIMETRY
Gravimetric surveys of Black Sea
[AD-737108] N72-25400

GRAVITATION
Explicit theory of orbit perturbations due to zonal gravitational harmonics N72-25738

GRAVITATIONAL EFFECTS
Gravity influenced parameters affecting solidification and crystal growth in tin
[NASA-TM-X-53999] N72-25693
Effects of earth gravity on synchronous orbit satellite altitude N72-25761

GREEN FUNCTION
Green function method and quasi-electrons in quantum mechanical multiple particle models
[DISS-4705] N72-25163

GRINDING [MATERIAL REMOVAL]
Grinding mixtures of powdered metals and inert fillers for conversion to halide
[NASA-CASE-LEW-10450-1] N72-25448

GROUND BASED CONTROL
Polar upper atmosphere data recorded at Kiruna Geophysical Observatory, Sweden, from Oct. - Dec. 1971 N72-25394

GROUND EFFECT MACHINES
Safety engineering in design and testing of tracked air cushion research vehicle N72-25987

GROUND STATE
Ground state properties of electron gas at metallic densities
[NUB-2126] N72-25629

GROUND STATIONS
Characteristics of multichannel radar system and specific application for solution of radar tracking problems N72-25197
Remote sensing of optical effects arising from refractive index variations of clear atmosphere by ground-to-ground line-of-sight optical methods N72-25352

GROUND SUPPORT SYSTEMS
Real time auxiliary computing facility for carrying out mission support and simulation programs during Apollo project
[NASA-TN-D-6855] N72-25223

GROUND-AIR-GROUND COMMUNICATIONS
Location identification system with ground based transmitter and aircraft borne receiver/decoder
[NASA-CASE-ERC-10324] N72-25173

GROUP THEORY
Orthogonal collineation for formulating metric planes by transformation axioms N72-25564

GUIDANCE [MOTION]
Display design for guidance and control
[AGARD-AR-43] N72-25419
Guide member for stabilizing cable of open shaft elevator
[NASA-CASE-KSC-10513] N72-25453

GUIDANCE SENSORS
Development of light sensing system for controlled orientation of object relative to sun or other light source
[NASA-CASE-NPO-11311] N72-25414

GUNN EFFECT
Multiterminal Gunn-type semiconductor microwave generator for producing stable signals
[NASA-CASE-XER-07895] N72-25679

GYROSCOPES
Development of experiments for testing inertial instruments in drag-free satellite
[AD-738309] N72-25608

H

H LINES
Detection method for intensity of hydrogen 3 cm and 21 cm lines in radio spectrum of sun
[AD-737850] N72-25839

HABITABILITY
Design guidelines for habitability and furniture elements for extended periods in zero gravity environment
[NASA-CR-115640] N72-25862

HABITS
Factors affecting migratory habits and orientation of sea turtles N72-25091

HAFNIUM ALLOYS
Thermomechanical and thermochemical behavior of high temperature, oxidation resistant, hafnium-20 percent tantalum alloy
[NASA-TM-X-68339] N72-25524

HALIDES
Grinding mixtures of powdered metals and inert fillers for conversion to halide
[NASA-CASE-LEW-10450-1] N72-25448

HALL EFFECT
Development of Hall effect transducer for converting mechanical shaft rotations into proportional electrical signals
[NASA-CASE-LAR-10620-1] N72-25255
Speed control system for dc motor equipped with brushless Hall effect device
[NASA-CASE-MFS-20207-1] N72-25267
Development and characteristics of magnetometer with single Bi2Se3 crystal as sensing element
[NASA-CASE-LEW-11632-1] N72-25440

HAMILTONIAN FUNCTIONS
Generalization of Hamiltonian and bilinear functional for nonself-adjoint mechanical systems
[REPT-64] N72-25459

HARTREE APPROXIMATION
Hartree-Fock identification of Kappa alpha satellites in light atoms
[CNRS-AO-4091] N72-25643

HEALTH PHYSICS
Specific aspects of Apollo health and quarantine programs considered for potential application to broad program required for protection of life and health of US astronauts in future manned space flight
[NASA-TN-D-6856] N72-25100
Radioactive waste management and wholesomeness of irradiated foodstuffs
[TID-25940] N72-25617

HEART
Mechanical heart and lungs system, with hypothetical polymer deformable upon contact with blood N72-25140

HEART RATE
Pulse modulated biotelemetry system for determining energy budgets in free-ranging vertebrates from heart rate and body temperature measurement N72-25123

HEAT BUDGET
Sea-air energy flux measurements from atmospheric budget, surface layer vertical eddy flux, and upper ocean heat budget data
[NOAA-TM-ERL-BOMAP-9] N72-25333

HEAT EXCHANGERS
Heat exchanger and decontamination system for multistage refrigeration unit
[NASA-CASE-NPO-10634] N72-25619

HEAT FLUX
Numerical analysis of radiant heat flux and local energy loss of line in region of strong variations of source function in one direction
[NASA-CR-126965] N72-25925

HEAT PIPES
Production of high purity radioiodine by bombardment of cesium heat pipe
[NASA-CASE-LEW-11390-1] N72-25645
Numerical analysis of heat transfer limitations for heat pipes operating at high and low temperatures
[NASA-CR-126739] N72-25915
Thermal performance tests for variable conductance heat pipe
[NASA-CR-123652] N72-25916

HEAT RESISTANT ALLOYS
Intermetallic coating for nickel based superalloy
[NASA-CASE-LEW-11348-1] N72-25517

HEAT SOURCES
Design and development of isotope heat source to meet requirements of steady-state operation and atmospheric entry
[NASA-TN-D-6833] N72-24994

HEAT TRANSFER
Heat transfer rate in hypersonic turbulent separated flow
[IC-AERO-72-05] N72-25310
Heat transfer and laminar incompressible boundary layer on corrugated wall applied to vaporizing combustion chamber
[DLR-FB-71-107] N72-25317
Aerothermodynamic integration model, including combustor design, flow distribution, and heat transfer problems
[NASA-CR-112058] N72-25713
Computer program for solving heat transfer problems by optical structural analysis N72-25763
Heat transfer tests of delta wing orbiter vehicle model in hypervelocity wind tunnel
[NASA-CR-120024] N72-25863
Thermal control system for spacecraft modular housing with heat pipes, louvres, and wall structures providing heat transfer path from module to space
[NASA-CASE-GSC-11018-1] N72-25871
Numerical analysis of heat transfer limitations for heat pipes operating at high and low temperatures
[NASA-CR-126739] N72-25915
Development of theory for interfacial thermal conductance between two heated metal plates in direct contact
[NASA-CR-126743] N72-25921

HEATING
Solid state welding of butt joint by fusion welding, surface cleaning, and heating in air
[NASA-CASE-LEW-11387-1] N72-25471

HEAVY IONS
Adaptation of Philips pulsed heavy gage ion source to bevatron
[LBL-304] N72-25613

HELICAL WINDINGS
Method for processing and plating helical coil with nickel cobalt
[NASA-CR-122418] N72-25478

HELICOPTERS
Applications of computers for flight test and evaluation of helicopters based on frequency analyses of load curves on main and tail rotors
[NASA-TT-F-14283] N72-24993

HELIUM
Q operator formalism for determining D autoionization states of atomic He and ionic H
[NASA-TM-X-65898] N72-25647
Concentration of injected helium tracer gas in rocket combustion chamber N72-25912

HELIUM ISOTOPES
Abundances in sun and solar wind and estimates of deuterium and helium 3 in protosolar gas N72-25725

Cosmic abundance of He-3 isotope determined from hyperfine radiation in galactic diffuse nebulae N72-25741

HETEROCYCLIC COMPOUNDS
Polarography of heterocyclic methaqualone, Dormutil, and ethinazone [RAE-LIB-TRANS-1608] N72-25165

HIGH ALTITUDE
Physiological evaluation of disposable jet transport passenger oxygen mask at high altitude [FAA-AM-72-10] N72-25131

HIGH ENERGY INTERACTIONS
Elementary pion with transverse momentum cutoff and pion contribution to neutron spectra in high energy reactions [NOTA-INTERNA-360] N72-25665

HIGH PRESSURE
Design, development, and installation of high pressure oxygen impact tester [NASA-CR-123643] N72-25418
Effect of high pressure in CO2 laser [AD-738270] N72-25508

HIGH RESOLUTION
Meteorological value of ultrasensitive radar N72-25363
Comments on high power, high resolution radars N72-25366

HIGH SPEED CAMERAS
Construction and operation of high speed rotary camera for photographing moving self-luminous objects [RAE-LIB-TRANS-1621] N72-25441
Applications of lasers as indirect light source for high speed photography N72-25504

HIGH STRENGTH
Method for making fiber composites with high strength at high temperatures [NASA-CASE-LEW-10424-2-2] N72-25539

HIGH TEMPERATURE
Collisional energy transfer during vibrational excitation of HF and DF at high temperature and pressure [AD-738296] N72-25168
Effects of creep and low cycle fatigue tests on alpha iron grain boundaries at 450 to 700 C [TN-10] N72-25512
Method for making fiber composites with high strength at high temperatures [NASA-CASE-LEW-10424-2-2] N72-25539
Mechanical behavior of alloys and metals during high temperature deformation [REPT-108] N72-25681

HIGH TEMPERATURE TESTS
Thermal vacuum tests of TBC-1 power performance at 715 and 935 C hot shoe temperatures [TID-25901] N72-25616

HIGHWAYS
Systems analysis for safety design of automobiles and highways N72-25984

HISTORIES
Illustrated biography of Wiley Post to record significant accomplishments in long range flight and aeronautical engineering N72-25952

HOLOGRAPHY
Holographic determination of krypton laser cavity ring spectrum [TPD-1971-0-2] N72-25264
Principles of holography and various methods for production of holograms N72-25495
Mathematical models and numerical analysis of coherent optical systems used as holographic schlieren system N72-25496
Application of aerodynamic holography for optical recording and flow visualization in wind tunnels and research facilities N72-25498
Principles for producing holograms and methods of recording interference pattern between reference beam and reflected light waves N72-25499
Calculation of diffraction efficiency and signal-to-noise ratio for two dimensional and volume diffuse-signal-beam holograms N72-25500
Development and characteristics of holography cameras for use with Q switched ruby lasers [NASA-CR-126767] N72-25501
Characteristics of solid state ruby laser and application for holographic recording N72-25502
Holographic recording of hypersonic projectile in tunnels, including elliptical device and aberrations [ISL-41/71] N72-25507
Velocity of particulate matter in laminar and turbulent gas flow, and holographic techniques [PB-206950] N72-25510

HOMING
Homing behavior of salamanders subjected to sensory impairment and manipulative techniques N72-25092

HOMING DEVICES
Location identification system with ground based transmitter and aircraft borne receiver/decoder [NASA-CASE-ERC-10324] N72-25173
Analysis of proportional navigation system used for missile guidance and comparison with theoretical system [AASU-313] N72-25597

HONEYCOMB CORES
Honeycomb core structures of minimum surface tubule sections [NASA-CASE-ERC-10363] N72-25541

HONEYCOMB STRUCTURES
Honeycomb panels of minimal surface, periodic tubule layers [NASA-CASE-ERC-10364] N72-25540

HORIZON SCANNERS
Transhorizon propagation or tropospheric scatter as possible tools for remote sensing in atmosphere N72-25367
Two atmospheric probing experiments, involving beyond-the-horizon propagation of microwave signals N72-25368
Transhorizon radio propagation for determining upper atmospheric structure N72-25370

HORN ANTENNAS
Multipurpose microwave antenna, employing dish reflector with plural coaxial horn feeds [NASA-CASE-NPO-11264] N72-25174

HUMAN BEHAVIOR
Design and operation of IMBLMS [NASA-CR-115664] N72-25143

HUMAN BODY
Tilting table for testing human body in variety of positions while exercising on ergometer or other biomedical devices [NASA-CASE-MFS-21010-1] N72-25127

HUMAN CENTRIFUGES
Human centrifuge tests to determine aircraft pilot disorientation during aircraft catapult launchings N72-25037

HUMAN FACTORS ENGINEERING
Development of standardized method for evaluating physical geometry of aircrew stations - Vol. I [AD-738006] N72-25015
Computer programs for improved methods for evaluating physical compatibility of crew members with crew stations - Vol. 3 [AD-738007] N72-25016
Development of mathematical model for evaluating compatibility of flight crew personnel and aircraft crew stations - Vol. 4 [AD-738008] N72-25017
Validation of man-model joint movement parameters to determine compatibility of flight crews and aircraft compartments - Vol. 5 [AD-738009] N72-25018
Human centrifuge tests to determine aircraft pilot disorientation during aircraft catapult launchings N72-25037
Development of theory concerning human reactions to whole body motion and explanation of individual differences to motion effects N72-25044
Behavior of gluteal region of human body subjected to varying loads in sitting position [AD-737225] N72-25110
Human factors engineering to determine effects of weapon noise on military personnel and development of criteria for performance prediction of personnel after exposure to noise [AD-738135] N72-25145
Human factors engineering applied to development of radar symbology and discrimination in mixed displays for cathode ray tube presentation [AD-738132] N72-25204
Universal system for assigning colors to terrain [AGARD-AG-159] N72-25346
Pilot safety considerations in design and operation of X-24A lifting body vehicle N72-25969

HUMAN PERFORMANCE
Effects of alcohol on problem solving tasks and vestibular stimulation [FAA-AM-72-11] N72-25108
Effects of specialized auditory stimuli on human performance of spatial orientation tasks [AD-737351] N72-25112

HUMAN REACTIONS
Development of theory concerning human reactions to whole body motion and explanation of individual differences to motion effects N72-25044
Application of methods of simulation of instrument flying as means of reducing occurrences of spatial disorientation in flight N72-25046

HURRICANES
Cylindrical chamber for simulating three dimensional flow in steady state hurricane N72-25286

HYDRAULIC EQUIPMENT
Design and characteristics of mechanically extended and telescoping boom on crane assembly [NASA-CASE-NPO-11118] N72-25021

HYDROCARBONS
Formaldehyde emission and H2CO absorption in Orion nebula [NASA-TM-X-65897] N72-25342
Actions of EPA for achieving 90 percent reduction of hydrocarbons in motor vehicle emissions by 1975 N72-25585

HYDROCHLORIC ACID
Annotated bibliography of documents on hydrochloric acid and air pollution [AP-100] N72-25588

HYDRODYNAMICS
Hydrodynamic forces on oscillating cylinder with trailing vortices N72-25293
Hydrodynamics and radiative transfer models for RR Lyrae stars N72-25732

HYDROFLUORIC ACID
Collisional energy transfer during vibrational excitation of HF and DF at high temperature and pressure [AD-738296] N72-25168

HYDROGEN
Gas chromatographic method for analyzing hydrogen deuterium mixtures [NASA-CASE-NPO-11322] N72-25146
Hydrogen fire blink detector for high altitude rocket or ground installation [NASA-CASE-MFS-15063] N72-25412
Role of hydrogen in formation of massive voids during electron beam welding of titanium and effect of various treatments on hydrogen contamination and elimination [RM-545] N72-25481
Q operator formalism for determining D autoionization states of atomic He and ionic H [NASA-TM-X-65898] N72-25647
High resolution nonlinear spectroscopy applied to line profile of Raman resonance in hydrogen gas [NOTA-INTERNA-349] N72-25662
Methods of attaining sufficient pressure for metallic hydrogen at room temperature [JPRS-56130] N72-25692
Photometric and photographic data used to identify new faint blue stars and study longitudinal distributions of interstellar absorption, H I, and H II across Carina spiral feature N72-25736
Galactic ionized hydrogen regions and electron temperatures [REPT-98] N72-25750

HYDROSTATIC PRESSURE
Effect of hydrostatic pressure on phonon spectrum of Pb-In alloys using electron tunneling N72-25654

HYOSCINE
Effectiveness of benactyzine hydrochloride and other antimotion sickness drugs combined with scopolamine [AD-737220] N72-25118

HYPERFINE STRUCTURE
Mechanical behavior of fine soils in lunar environment in engineering gravity flow bins [BM-RI-7543] N72-25472
Hyperfine structure in crystal calcium tungstate determined by combination of electron paramagnetic resonance and electron nuclear double resonance techniques [NASA-CR-126751] N72-25683
Cosmic abundance of He-3 isotope determined from hyperfine radiation in galactic diffuse nebulae N72-25741

HYPERSONIC FLOW
Hypersonic spherical source flow with rarefied background, using Boltzmann equation [RE-427J] N72-25304
Heat transfer rate in hypersonic turbulent separated flow [IC-AERO-72-05] N72-25310
Mass spectrometry measurements of hypersonic flow in shock tubes [ISL-37/71] N72-25444
Experimental method for measuring heat transfer in hypersonic aerodynamic models [REPT-32] N72-25918

HYPERSONIC SPEED
Design and development of isotope heat source to meet requirements of steady-state operation and atmospheric entry [NASA-TN-D-6833] N72-24994
Large mass flow of high temperature air at hypersonic speeds [NASA-CASE-LAR-10612-1] N72-25307
Holographic recording of hypersonic projectile in tunnels, including elliptical device and aberrations [ISL-41/71] N72-25507

HYPERVELOCITY WIND TUNNELS
Heat transfer tests of delta wing orbiter vehicle model in hypervelocity wind tunnel [NASA-CR-120024] N72-25863

HYSTERESIS
Characteristics of noise immune switching gates with hysteresis loops
N72-25266

I

IBM COMPUTERS
Real time data acquisition and processing using IBM computers
N72-25240

ILLUMINATION
Applications of lasers as indirect light source for high speed photography
N72-25504

IMAGE DISSECTOR TUBES
Image dissector camera system for high resolution multispectral imagery
N72-25781

IMAGE ENHANCEMENT
Design optimizations of space astronomical telescopes with nested geometries
N72-25779

IMAGE MOTION COMPENSATION
Effects of focal plane shutter and image motion compensation on Lunar Orbiter photography
N72-25415

IMBLMS
Design and operation of IMBLMS
[NASA-CR-115664] N72-25143

IMPACT
Manual for computer analysis of structural strain and hypervelocity impacts
[NASA-CR-126749] N72-25219
Mathematical model of impact between finite cylindrical free jet and rigid smooth wall
[PB-206912] N72-25322
Measurement of sound attenuation after impact of steel balls on plates
[REPT-7107.521] N72-25625

IMPACT TESTS
Design, development, and installation of high pressure oxygen impact tester
[NASA-CR-123643] N72-25418

IMPACTORS
Equipment and polyhydric chemicals for dispersing fog - Foggy Cloud 4 Project
[TOPR-178-1-121] N72-25154

IMPROVED TIROS OPERATIONAL SATELLITES
Radiometer and proton monitor data, processing, and hardware on ITOS satellites
[NOAA-TM-NESS-29] N72-25721

INCENDIARY AMMUNITION
Feasibility of forced convection ignition tests on cartridge powder
[TL-1971-16] N72-25919
Thermodynamic and gas dynamic properties of solid ammunition ignition
[TL-1971-17] N72-25920

INCONEL [TRADEMARK]
Effects of temperature, grain size, and strain rate on fracture behavior of Inconel alloy X-750
[TN-11] N72-25905

INDEPENDENT VARIABLES
Parameter effects on short arc satellite survey adjustments and GEOS I minitrack observations
[NASA-TM-X-65896] N72-25830

INDEXES
Indexes for inventory of energy research
N72-25931

INDEXES [DOCUMENTATION]
FAA index on aviation medicine and aeromedical data reports
[FAA-AM-72-1] N72-25103
Indexes for research projects on energy sources
[ORNL-EIS-72-18-VOL-2] N72-25658
Abstracts and indexes on plasma instabilities
[AD-738218] N72-25676

INDIUM ALLOYS
Effect of hydrostatic pressure on phonon spectrum of Pb-In alloys using electron tunneling
N72-25654
Ac susceptibility, dc magnetization, and specific heat capacity methods for measuring superconducting properties of fast frozen In-Ga alloys
[TID-25864] N72-25694

INDIUM ANTIMONIDES
Transport properties and microwave emission in n-type InSb at liquid nitrogen temperature
N72-25684

INDUSTRIAL MANAGEMENT
Reliability analysis on petroleum industry requirements
N72-25986

INDUSTRIAL SAFETY
Application of systems theory to safety management
N72-25963
Data requirements analysis for operation of user-oriented safety data bank
N72-25964
Effects of legal interpretations on system safety
N72-25965
Factors causing system safety programs to fail
N72-25966
Application of system safety engineering principles to industrial engineering
N72-25971

INDUSTRIES
Defense, medical and industrial research in Canada for 1971
[DR-214] N72-25930
National aviation system plan 1973-1982, as joint industry-government program
[REPT-1000.27-APP-2] N72-25950

INFORMATION MANAGEMENT
Data requirements analysis for operation of user-oriented safety data bank
N72-25964

INFRARED ASTRONOMY
Far infrared sources in galactic H II regions, and possible relation to thermal radio sources and interstellar dust
N72-25737

INFRARED DETECTORS
Infrared radiometer and video scan system for remote sensing of root rot disease in Pacific Northwest Douglas fir tree population
[NASA-CR-126719] N72-25029

INFRARED LASERS
Infrared tunable laser with wavelength-selective reflectors, lasable dye solutions, and nonlinear mixing crystal
[NASA-CASE-ARC-10463-1] N72-25268

INFRARED RADIATION
Analyzing use of infrared radiometry for remote atmospheric probing
N72-25378

INFRARED SPECTRA
Infrared absorption properties of N2O from 760 to 2380/cm
[AD-737839] N72-25169
Remote atmospheric probing approaches in infrared from satellites for Global Atmospheric Research Program
N72-25377
Listing of infrared molecular spectra and laboratory conditions
[NASA-CR-126985] N72-25648
Spectra in 2 micron atmospheric window for late-type dwarfs, giants, supergiants, and long-period variables
N72-25739

INFRARED SPECTROMETERS
Using airborne scanning infrared spectrometer for remote detection of CAT
N72-25379

INFRASONIC FREQUENCIES
Atmospheric propagation of sound waves at infrasonic frequencies
N72-25385
Infrasound used for probing upper atmosphere structure and motion
[REPT-1245] N72-25387
Comparison of infrasonic background noise with atmospheric jet streams
[KGO-724] N72-25392
Underground nuclear explosion infrasonic frequency detection noting supersonic signals
[KGO-722] N72-25393

INHOMOGENEITY
Passage of ionizing radiation through inhomogeneities in radiation shielding
[TT-70-50155] N72-25641

INJECTORS
Coaxial injector for mixing liquid propellants within combustion chambers
[NASA-CASE-NPO-11095] N72-25455

INKS
Conductive thick film inks, including unfired inks
[NASA-CR-126973] N72-25688

INLET FLOW
Unsteady response of turbocompressor with inlet flow distorted by square wave and triangular spoilers
[ARC-CP-1203] N72-25000

INPUT
Automata functioning in stationary random media with restricted length of input word and minimization of losses
N72-25138

INSECTS
Function of visual cues in orientation navigation systems of desert ants
N72-25088
Directional orientation of dragonfly relative to azimuth of sun
N72-25094

INSTRUMENT APPROACH
Aircraft accident involving DC-9 charter flight on instrument landing approach to Huntington, West Virginia airport on 14 November, 1970
[NTSB-AAR-72-11] N72-25006
Pilot tracking performance during in-flight simulated instrument approaches with single engine general aviation aircraft
[FAA-AM-72-9] N72-25130

INSTRUMENT ERRORS
Error analysis in measuring geomagnetic field components with self-oscillating quantum magnetometer with auxiliary alternating fields
N72-25433
Analysis of errors of quantum magnetometer in measuring inclination and declination
N72-25437

INSTRUMENT LANDING SYSTEMS
Requirements for channel splitting to accommodate increased VHF omnirange navigation instrument landing systems, and distance measuring equipment facilities
[PAPER-54-71/SC122-3] N72-25602
Evaluation of STOL modular instrument landing system
[FAA-NA-72-11] N72-25605
Instrument landing system simulator including special signal generator for environment simulation
[RAE-TR-71145] N72-25607

INSTRUMENTS
Development of apparatus for mounting scientific experiments in spacecraft to permit utilization without maneuvering spacecraft
[NASA-CASE-MSC-12372-1] N72-25842

INSULATION
Damage due to local internal electric discharges in insulating polymeric materials
N72-25552

INTEGRATED CIRCUITS
Integrated circuit tangent function generator
[NASA-CASE-MSC-13907-1] N72-25281

INTERFEROMETERS
Principles for producing holograms and methods of recording interference pattern between reference beam and reflected light waves
N72-25499
Analysis of navigation concept with single radiating interferometer on spinning synchronous satellite
N72-25596

INTERFEROMETRY
Application of laser beams for measurement of aerodynamic flow fields at supersonic and hypersonic speeds
N72-25503

INTERMETALLICS
Intermetallic coating for nickel based superalloy
[NASA-CASE-LEW-11348-1] N72-25517
Band model calculation for electron phonon coupling in intermetallic A15 compounds
N72-25644

INTERNAL COMBUSTION ENGINES
Actions of EPA for achieving 90 percent reduction of hydrocarbons in motor vehicle emissions by 1975
N72-25585

INTERNATIONAL COOPERATION
International cooperation and voluntary assistance in meteorological projects in 1971
[WMO-323] N72-25591
Operational principles of international cooperation in space exploration - conference
[S-DOC-92-57] N72-25951
International liability and space exploration
N72-25957

INTERNATIONAL SYSTEM OF UNITS
Findings of US government study group on advantages and problems associated with converting industry and science to metric system of measurements
N72-25469

INTERPLANETARY FLIGHT
Solar cell activated silver zinc battery for interplanetary flight
N72-25767

INTERPLANETARY GAS
Interplanetary plasma diagnostics and solar wind observations during normal and disturbed times
N72-25815

INTERPLANETARY MAGNETIC FIELDS
Effects of substorm activity, interplanetary magnetic field latitude, and dipole tilt angle on high-latitude precipitation of 700-eV electrons, determined from OGO 4 data
[NASA-TM-X-65902] N72-25832

INTERPLANETARY SPACE
Hydrodynamics and thermodynamics of corona and its expansion into interplanetary space, and flare-produced shock wave propagation
N72-25814

INTERSTELLAR EXTINCTION
Interstellar absorption of Crab nebula soft X ray flux and X ray spectrum of Crab pulsar
N72-25734

INTERSTELLAR MATTER
Far infrared sources in galactic H II regions, and possible relation to thermal radio sources and interstellar dust
N72-25737

INTOXICATION
Procedure for determining cases of mild intoxication based on postrotational fixation nystagmus
N72-25039
Alcohol-induced postrotatory fixational nystagmus and detection of alcohol intoxication in pilots
N72-25060

INVARIANCE
Stochastic stability, invariance theorems, and systems with randomly varying coefficients
[CDS-TR-72-2] N72-25559
Invariant coefficients of characteristic polynomial for n X n matrix
[NASA-TM-X-65885] N72-25562
INVERSIONS
Inversion algorithm for satellite radiometric observations
N72-25376
INVERTERS
Inverter oscillator with voltage feedback
[NASA-CASE-NPO-10760] N72-25254
INVISCID FLOW
Prediction method for subsonic flow of inviscid fluid through duct of arbitrary cross section
N72-25294
IODINE ISOTOPES
Production of high purity radioiodine by bombardment of cesium heat pipe
[NASA-CASE-LEW-11390-1] N72-25645
ION BEAMS
Electric potential distribution along ion beam with application to Penning discharge
[TRITA-EPP-71-26] N72-25674
ION DENSITY (CONCENTRATION)
Electron energy plasma ion density, and electric potential in simulated thermionic energy converter
[NASA-CR-126866] N72-25668
ION ENGINES
Completely modularized nuclear reactor powered ion propulsion system
[NASA-CR-126865] N72-25703
Analysis of requirements for thermionic reactor electric propulsion system
[NASA-CR-126867] N72-25704
Design of satellite telecommunication system stabilized by ion thrusters
[PUBL-893] N72-25847
ION INJECTION
Fabrication of miniature electronic equipment by masking and superposition of layers using electron bombardment and ion injection
N72-25283
Ion implanter characteristics for electronic component design
[CEA-CONF-1871] N72-25656
ION SCATTERING
Measurement of vector ion transport velocities in F region based on line of sight plasma motion and Doppler shift of returned incoherent scatter spectrum
N72-25328
ION SOURCES
Adaptation of Philips pulsed heavy gage ion source to bevatron
[LBL-304] N72-25613
IONIZATION
Plasma collisions producing multiply charged heavy ions
[EUR-CEA-FC-624] N72-25670
IONIZED GASES
Galactic ionized hydrogen regions and electron temperatures
[REPT-98] N72-25750
IONIZING RADIATION
Bibliographic survey of series emittance thermal control coatings including materials properties and resistance to radiation
[ONERA-DERTS-NT-03-8] N72-25554
Passage of ionizing radiation through inhomogeneities in radiation shielding
[TT-70-50155] N72-25641
IONOSPHERE
Radio and space research 1968-1970, including upper ionosphere, energetic particles, and solar physics studies
[NP-19177] N72-25198
Geophysics and space data
[AD-738327] N72-25397
IONOSPHERIC CONDUCTIVITY
Ionospheric double layers in topside and F region, stability, and anomalous resistivity
[TRITA-EPP-72-07] N72-25395
IONOSPHERIC CURRENTS
Ionospheric double layers in topside and F region, stability, and anomalous resistivity
[TRITA-EPP-72-07] N72-25395
IONOSPHERIC DISTURBANCES
Characteristics of plane wave and localized disturbances affecting ultralow frequency and extremely low frequency propagation in ionosphere
N72-25178
IONOSPHERIC ELECTRON DENSITY
Ionospheric bias correction methods in radio tracking of spacecraft
N72-25756
IONOSPHERIC ION DENSITY
Solar activity variation of ionospheric ion composition and variation of NO[plus]/O[plus] ratio during day in E and F regions
[RSD-67] N72-25719
IONOSPHERIC PROPAGATION
Characteristics of plane wave and localized disturbances affecting ultralow frequency and extremely low frequency propagation in ionosphere
N72-25178
HF backscatter system for collecting auroral clutter data
[AD-738305] N72-25203
IONOSPHERIC SOUNDING
Temperature and water vapor soundings from HF infrared radiometry with high vertical resolution
N72-25374
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Apr. - June 1971
N72-25390
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Jul. - Sep. 1971
N72-25391
Geophysics and space data
[AD-738327] N72-25397
IONS
Positive ion composition and metallic ion layer in equatorial E region
[NASA-TM-X-65891] N72-25341
IRISES [MECHANICAL APERTURES]
Waveguide, thin film window and microwave irises
[NASA-CASE-LAR-10513-1] N72-25170
IRON
Effects of creep and low cycle fatigue tests on alpha iron grain boundaries at 450 to 700 C
[TN-10] N72-25512
Near ultraviolet spectra and Zeeman effects of iron and titanium containing corundum crystals
[DISS-4600] N72-25689
IRRADIATION
Process for depositing pure metals by irradiating liquids
[NASA-CASE-LEW-10906-1] N72-25164
Radioactive waste management and wholesomeness of irradiated foodstuffs
[TID-25940] N72-25617
ISOPERIMETRIC PROBLEM
Limits for lowest eigenvalues in problems containing an alpha parameter
[DISS-4727] N72-25569
ISOTOPE SEPARATION
Nonstationary states of isotope mixtures in thermal diffusion columns
N72-25667
ISOTOPES
Design and development of isotope heat source to meet requirements of steady-state operation and atmospheric entry
[NASA-TN-D-6833] N72-24994
ISOTROPIC TURBULENCE
Local isotropy and turbulent fluctuations of refractive index in surface layer of atmosphere
N72-25353
ITERATIVE SOLUTION
Development of convergent iteration procedure for determining roots of polynomials and computer program for machine calculation of complex series
[DISS-4653] N72-25566
Iterative plate solution for flat shells in bending mode
[REPT-67] N72-25887

J

JAPAN
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for July 1971
N72-25578
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for Aug. 1971
N72-25579
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for Sept. 1971
N72-25580
JEANS THEORY
Jeans criterion and formation of stars within nucleus of quasar
[FRNC-TH-138] N72-25657
JET AIRCRAFT
Numerical analysis of finite amplitude waves generated by aircraft trailing vortices to indicate growth of waves on pair of parallel infinite vortices
[AD-737859] N72-25012
JET AIRCRAFT NOISE
Theoretical acoustics applied to jet engine noise generation, propagation, and reduction studies
N72-25632
Method for computing noise generated by standing and flying jet aircraft
[ONERA-NT-187] N72-25636
JET ENGINE FUELS
Analytical measurements of exhaust emissions from aircraft turbine engines using Jet A fuel
[BM-RI-7634] N72-25584
JET ENGINES
Magnetic force welding to form T joints between jet engine parts of dissimilar thickness
[NASA-CASE-LEW-10533-2] N72-25479
JET FLAPS
Review of work on external flow jet flaps noting lift coefficient
[ARC-CP-1194] N72-24998
JET FLOW
Two-phase flow system with discrete, impinging two-phase jets
[NASA-CASE-NPO-11556] N72-25292
JET STREAMS [METEOROLOGY]
Comparison of infrasonic background noise with atmospheric jet streams
[KGO-724] N72-25392
JOINTS [JUNCTIONS]
Procedure and apparatus for ultrasonic tests of welded Y joints and Inconel tubes
[TR-7108.533] N72-25458
Solid state welding of butt joint by fusion welding, surface cleaning, and heating in air
[NASA-CASE-LEW-11387-1] N72-25471
JUPITER [PLANET]
Interior structure of Jupiter and other giant planets
N72-25818

K

KEPLER LAWS
Transformation of motion equations in disturbed Kepler boundary problem of celestial mechanics
[DISS-4676] N72-25570
KRYPTON
Holographic determination of krypton laser cavity ring spectrum
[TPD-1971-0-2] N72-25264

L

LABORATORY EQUIPMENT
Development of variable angle device for positioning test tubes to permit optimum drying of culture medium
[NASA-CASE-LAR-10507-1] N72-25284
LAMINAR BOUNDARY LAYER
Integral methods for predicting characteristics of laminar boundary layer-shock wave interactions
[IC-AERO-72-01] N72-25312
Heat transfer and laminar incompressible boundary layer on corrugated wall applied to vaporizing combustion chamber
[DLR-FB-71-107] N72-25317
Forced response of laminar boundary layers to free stream oscillations in oscillating flow wind tunnel
[AD-737856] N72-25318
LAMINAR FLOW
Effect of disturbances produced by vibrating ribbon on accelerated laminar boundary layer at low Reynolds numbers
[AD-738335] N72-25321
LAMINATES
Polymeric film-metal-film sandwich laminate for reduced permeability material of cryogenic expulsion bladder
[NASA-CR-120892] N72-25159
Stiffness and mass matrices for laminated, anisotropic, quadrilateral thin shell, based on kinetic and strain energy principles
N72-25876
LANDING AIDS
Performance and problems of microwave guidance systems for aircraft approach and landing
[RAE-TR-71186] N72-25606
LANDING GEAR
Design, development, and performance of lunar module landing gear subsystem
[NASA-TN-D-6850] N72-25903
LANGUAGE PROGRAMMING
JOSS - conversational computing system for computer novice
[R-918] N72-25935
LARMOR PRECESSION
Self-oscillating magnetometer using linearly polarized light modified with Larmor precession frequency
N72-25432
LASER MATERIALS
Principles of laser operation to include materials, resonant cavity construction, and theory of atomic energy levels
N72-25494
Characteristics of solid state ruby laser and application for holographic recording
N72-25502
LASER MODES
Xenon flashlamp driver system for optical laser pumping
[NASA-CASE-ERC-10283] N72-25485
Principles of laser operation to include materials, resonant cavity construction, and theory of atomic energy levels
N72-25494
LASER OUTPUTS
Proceedings of conference on applications of laser technology for aerodynamic measurements
[AGARD-LS-49] N72-25493

Principles of laser operation to include materials, resonant cavity construction, and theory of atomic energy levels
N72-25494
Principles of holography and various methods for production of holograms
N72-25495
Comparison of coherent and conventional light sources to show advantages of coherent light for optical experiments
N72-25497
Development and characteristics of holography cameras for use with Q switched ruby lasers
[NASA-CR-126767] N72-25501
Characteristics of solid state ruby laser and application for holographic recording
N72-25502
Application of laser beams for measurement of aerodynamic flow fields at supersonic and hypersonic speeds
N72-25503
Applications of lasers as indirect light source for high speed photography
N72-25504
Development and characteristics of dual scatter laser Doppler velocimeter for flow distribution measurement in wind tunnels, helicopter downwash, and across high lift wing sections
N72-25506
Development and characteristics of optical equipment for collimation of laser energy
[AD-738288] N72-25509

LASER RANGE FINDERS
Unfiltered photon data from laser ranging between McDonald Observatory and reflector at Tranquility Base
[NASA-CR-126747] N72-25486
Improvements in laser range noise and bias for satellite tracking
N72-25792

LASERS
Incoherent and coherent CW laser systems for remote atmospheric probing
N72-25355
Optical radar technique using laser energy for studying atmosphere
N72-25357
Development of laser testing technique for determining zero shift and change in sensitivity of pressure transducer
[NBS-TN-723] N72-25487
Short range obstacle detector for surface vehicles using laser diode array
[NASA-CASE-NPO-11856-1] N72-25490
Carrier tracking loop for phase lock micrometer laser receiver
N72-25771
Man-portable laser beacon and receiver system for land survey
N72-25802

LAUNCH VEHICLES
Test facility for analyzing pogo phenomenon in liquid fuel launch vehicles
N72-25841
Conducting exploratory investigations beyond Mars orbit by Pioneer F/G program
[NASA-TM-X-68340] N72-25866

LAW [JURISPRUDENCE]
Laws governing military use of civil aircraft
N72-25960
Effects of legal interpretations on system safety
N72-25965

LEAD ALLOYS
Effect of hydrostatic pressure on phonon spectrum of Pb-In alloys using electron tunneling
N72-25654

LEADING EDGES
Analysis of leading edge flow separation resulting from airfoils oscillating in uniform flow field at low Reynolds numbers
[AD-738304] N72-25320
Aerothermodynamic integration model, including flow paths, leading edges, and ducts
[NASA-CR-112059] N72-25714

LEAST SQUARES METHOD
Process for computing least squares polynomial approximation of data points and transmission media computer program
[NASA-CR-126970] N72-25563

LEGAL LIABILITY
International liability and space exploration
N72-25957

LENS DESIGN
Design optimizations of space astronomical telescopes with nested geometries
N72-25779

LIAPUNOV FUNCTIONS
Development of Liapunov functional for continuous, nonconservative systems with damping
[REPT-66] N72-25886

LIFE SUPPORT SYSTEMS
Specific aspects of Apollo health and quarantine programs considered for potential application to broad program required for protection of life and health of US astronauts in future manned space flight
[NASA-TN-D-6856] N72-25100
Environmental control/life support system for four-man, seven-day orbital shuttle
[NASA-CR-1981] N72-25126
Development of regenerable or partially regenerable life support systems use in EVA protective systems
[NASA-CR-114382] N72-25133
Service life and performance of one man electrochemical CO2 concentrator
[NASA-CR-114426] N72-25134

LIFT
Review of work on external flow jet flaps noting lift coefficient
[ARC-CP-1194] N72-24998

LIFTING BODIES
Numerical analysis of nonhomogeneous flow in two dimensional propulsive lifting system
N72-25296

LIFTING ROTORS
Application of state transition matrix for numerical analysis of stability and gust response of lifting rotor with rigid flapping blades and rigid hub
N72-25001

LIGHT MODULATION
Lamp modulator for generating visual indication of presence and magnitude of signal
[NASA-CASE-KSC-10565] N72-25250

LIGHT SOURCES
Light source position measuring mechanism of homing pigeons
N72-25080

LIGHTING EQUIPMENT
Physical characteristics, and system effectiveness of high power airborne military illuminating sources
[AD-737832] N72-25678

LIMITS [MATHEMATICS]
Proving of Boltzmann limit conjecture for two- and three-dimensional Lorentz gas with hard core molecular collisions
[NOTA-INTERNA-358] N72-25638

LINE SPECTRA
High resolution nonlinear spectroscopy applied to line profile of Raman resonance in hydrogen gas
[NOTA-INTERNA-349] N72-25662
Near ultraviolet spectra and Zeeman effects of iron and titanium containing corundum crystals
[DISS-4600] N72-25689
Equivalent widths of line spectra for late F dwarfs
[BULL-167] N72-25745
Spectral line constants, solar equivalent widths, and desaturated values for late stars
[BULL-168] N72-25746
Comparison of continuum radiation and spectral line radiation in W3 and W51 regions
[RR-96] N72-25748

LINEAR EQUATIONS
Finite difference schemes for solving linear dynamic plate and shell equations
N72-25878

LINEAR PROGRAMMING
Elastic-plastic deformation analysis of plane frames using linear programming
[REPT-88] N72-25896

LINEAR SYSTEMS
Controllability of linear, time invariant, delay differential system
[NASA-TM-X-65888] N72-25561

LIQUID COOLING
Automatic temperature control for liquid cooled space suit
[NASA-CASE-ARC-10599-1] N72-25129
Flightweight components and water cooled test adapters for hypersonic engine
[NASA-CR-112055] N72-25711

LIQUID CRYSTALS
Development of combined velocimeter and accelerometer based on color changes in liquid crystalline material subjected to shear stresses
[NASA-CASE-ERC-10292] N72-25410
Input signal measurement using liquid crystalline elements
[NASA-CASE-ERC-10275] N72-25680

LIQUID FILLED SHELLS
Test facility for analyzing pogo phenomenon in liquid fuel launch vehicles
N72-25841
Numerical analysis of vibrations and stability of fluid filled shells and gas flowing through shells as viscous incompressible fluid
N72-25907

LIQUID HYDROGEN
Development of method for determining buckling characteristics of disposable liquid hydrogen tank used on space shuttles
[RM-540] N72-25906

LIQUID ROCKET PROPELLANTS
Advanced techniques for determining long term performance of spacecraft liquid propulsion system components
[NASA-CR-126720] N72-25845

LIQUIDS
Microwave circuit for measuring complex dielectric constant of polar liquid by cavity perturbation method
[NOTA-INTERNA-352] N72-25637
Ablative system with liquid carrying ablattive material bodies and forming self-replacing ablative surface
[NASA-CASE-LEW-10359] N72-25911

LITERATURE
Summary of literature on altimeter display relating to aircraft height
[FAA-RD-72-46] N72-25426

LITHIUM ISOTOPES
Factors affecting design of albedo-neutron dosimeters, using Li-6 and Li-7 thermoluminescent dosimetry systems
[LA-4832] N72-25442
Li-6/Li-7 ratio for F, G, and early K field stars determined theoretically and with Fabry-Perot interferometer
N72-25735

LOADS [FORCES]
Measuring device for bearing preload using spring washers
[NASA-CASE-MFS-20434] N72-25288
Computerized optimal control for synthesis of load relief control system of Saturn 5 derivative launch vehicle
[NASA-CR-123646] N72-25465
Multiple eigenvalue analysis on structural vibrations of linear systems with estimation of frequency boundary stability
[REPT-43] N72-25881
Pressure vessel analysis of shape, dimensions, and loads
[WTHD-35] N72-25901

LOCATES SYSTEM
Location identification system with ground based transmitter and aircraft borne receiver/decoder
[NASA-CASE-ERC-10324] N72-25173

LOCOMOTION
Effect of chemical stimuli on orientation behavior of fish
N72-25090
Restraint torso for increased mobility and reduced physiological effects while wearing pressurized suits
[NASA-CASE-MSC-12397-1] N72-25119

LOGIC CIRCUITS
Logic system for design and fabrication of telemetry ground data processing equipment
N72-25797

LOGISTICS
Logistics curves used for describing scientific, shipping, and population versus time relations
N72-25141

LONG TERM EFFECTS
Advanced techniques for determining long term performance of spacecraft liquid propulsion system components
[NASA-CR-126720] N72-25845

LOOP ANTENNAS
Digital computer technique for servo and control systems of large antennas
N72-25794

LORAN
Development of system for automatic time synchronization based on Loran system timing networks
[RR-104] N72-25598

LORENTZ GAS
Proving of Boltzmann limit conjecture for two- and three-dimensional Lorentz gas with hard core molecular collisions
[NOTA-INTERNA-358] N72-25638

LOW PASS FILTERS
Low pass filter requirements and performance in variable speed constant frequency system for aircraft electric power supplies
[RAE-TR-71088] N72-25273

LOW TEMPERATURE
Relationship of dislocations of silicon to solar cell current loss at low temperature
[NASA-TM-X-68055] N72-25023
Transport properties and microwave emission in n-type InSb at liquid nitrogen temperature
N72-25684
Spontaneous luminescence of CdSe and CdS at low temperature, excited by mercury lamp
[AD-737910] N72-25698

LOW TEMPERATURE PHYSICS
Acoustic velocity, lattice vibrations, and magnetic permeability of A15 phase in superconducting intermetallic compounds
N72-25686

LOWER ATMOSPHERE
Local isotropy and turbulent fluctuations of refractive index in surface layer of atmosphere
N72-25353
Use of acoustic waves for remote probing of lower atmosphere
N72-25384
Composition, thermal structure, density, and unusual characteristics of planetary lower atmospheres, emphasizing Mars, Venus, and Jupiter atmospheres
N72-25816

LUMINAIRES
Lamp modulator for generating visual indication of presence and magnitude of signal
[NASA-CASE-KSC-10565] N72-25250

LUMINESCENCE
Spontaneous luminescence of CdSe and CdS at low temperature, excited by mercury lamp
[AD-737910] N72-25698

LUMINOUS INTENSITY
Statistical analysis of radiation intensity in emission spectroscopy
[EUR-4716] N72-25655

LUNAR ATMOSPHERES
Performance tests of lunar mass spectrometer designed to sample and measure gases in lunar atmosphere at surface
[NASA-CR-126772] N72-25429

LUNAR COMMUNICATION
Three transceiver lunar emergency system to relay voice communication of astronaut
[NASA-CASE-MFS-21042] N72-25171
Postflight analysis of EVCS to LM communications link for Apollo 15 mission to verify performance prediction techniques
[NASA-TM-X-68426] N72-25183

LUNAR CRATERS
Lunar cratering, nature of Apollo 11 soils, and geological implications of anothosite fragments in soil
N72-25820

LUNAR EVOLUTION
Solar system, solar physics, planetary atmospheres and structure, and origin of planets and moon - conference
[NASA-SP-300] N72-25810
Lunar cratering, nature of Apollo 11 soils, and geological implications of anothosite fragments in soil
N72-25820
Dynamic equations of earth-moon system integrated back in time to study early orbit and origin of moon
N72-25823

LUNAR EXPLORATION
Three transceiver lunar emergency system to relay voice communication of astronaut
[NASA-CASE-MFS-21042] N72-25171
Astronauts report to House Committee on Apollo 16 flight, EVAs, lunar and earth photographs, and scientific experiments
N72-25835

LUNAR FLIGHT
Use of computer programs as navigation aid during contingency lunar mission planning
[NASA-TN-D-6853] N72-25600

LUNAR GEOLOGY
Lunar cratering, nature of Apollo 11 soils, and geological implications of anothosite fragments in soil
N72-25820

LUNAR LANDING
Lunar module 5 reaction control system performance during descent and ascent
[NASA-TM-X-68342] N72-25846

LUNAR LUMINESCENCE
Nocturnal orientation by amphipods using moonlight
N72-25095

LUNAR MODULE
Apollo mission planning for lunar module descent and ascent based on postflight analysis of previous missions
[NASA-TN-D-6846] N72-25855
Design of lunar module signal conditioning, caution and warning, and data storage electronics instrumentation subsystems
[NASA-TN-D-6845] N72-25856
Design, development, and performance of lunar module landing gear subsystem
[NASA-TN-D-6850] N72-25903
Management of confidence limits in lunar module design
N72-25978

LUNAR MODULE 5
Lunar module 5 reaction control system performance during descent and ascent
[NASA-TM-X-68342] N72-25846

LUNAR ORBITER
Effects of focal plane shutter and image motion compensation on Lunar Orbiter photography
N72-25415

LUNAR ORBITS
Eccentricity perturbation prediction for lunar orbit of Radio Astronomy Explorer satellite
N72-25758

LUNAR RECEIVING LABORATORY
Fabrication and operational procedures for processing lunar samples in sterile nitrogen atmosphere
[NASA-TN-D-6858] N72-25099

LUNAR ROCKS
General principles and detailed procedures on lapping, gluing, and polishing of ultrathin samples of lunar rocks and particulates - manuals
[NASA-CR-115554] N72-25744
Neutron activation data for Apollo 12 rocks and soils
[NASA-CR-115570] N72-25754
Trapped solar wind rare gases and isotope ratios for Apollo 12 fines and Apollo 11 breccia
N72-25833

LUNAR SEISMOGRAPHS
Worst case failure analysis on explosive package for lunar seismology experiment
N72-25980

LUNAR SOIL
Fabrication and operational procedures for processing lunar samples in sterile nitrogen atmosphere
[NASA-TN-D-6858] N72-25099
Neutron activation data for Apollo 12 rocks and soils
[NASA-CR-115570] N72-25754
Lunar cratering, nature of Apollo 11 soils, and geological implications of anothosite fragments in soil
N72-25820
Trapped solar wind rare gases and isotope ratios for Apollo 12 fines and Apollo 11 breccia
N72-25833

LUNAR SURFACE VEHICLES
Walking and wheel rotation capabilities of lunar transportation vehicle
N72-25285

LUNAR TOPOGRAPHY
Small displacement, strain, finite element technique, using constant strain triangle for gravity flow of powder
[BM-RI-7577] N72-25473

LUNGS
Mechanical heart and lungs system, with hypothetical polymer deformable upon contact with blood
N72-25140

LYMAN ALPHA RADIATION
Damage to thermal aluminum coating caused by short wavelength ultraviolet radiation
N72-25769

LYRAE CONSTELLATION
Hydrodynamics and radiative transfer models for RR Lyrae stars
N72-25732

M

MACH NUMBER
Effect of cooling on near wake of two dimensional circular cylinder at Mach number 6
N72-25298

MACHINE ORIENTED LANGUAGES
Computer development, noting improvements by multiprogramming, buffer stores, and software evolution
N72-25234

MAGNESIUM FLUORIDES
Mathematical model for magnesium fluoride degradation due to electron irradiation
[ONERA-DERTS-NT-02-29] N72-25553

MAGNETIC COILS
Method for processing and plating helical coil with nickel cobalt
[NASA-CR-122418] N72-25478

MAGNETIC FIELDS
Magnetoreception and orientation in dancing bees
N72-25096
Use of magnetic cues to select migratory direction by European robins
N72-25097
Measurement of electric fields, magnetic fields, and charged particles in auroral band using Nike-Tomahawk rocket vehicle
N72-25326
Measurement of vector ion transport velocities in F region based on line of sight plasma motion and Doppler shift of returned incoherent scatter spectrum
N72-25328
Quantum interference fluxmeter with superconducting sensor having circuit loop with sharp constrictions, for measuring weak magnetic fields
N72-25431
Magnetic force welding to form T joints between jet engine parts of dissimilar thickness
[NASA-CASE-LEW-10533-2] N72-25479

MAGNETIC INDUCTION
Approximate compensation in airborne magnetometry for changing inductive field of aircraft moving through varying geomagnetic field
N72-25435

MAGNETIC MEASUREMENT
Magnetometer designs for measuring weak and very weak magnetic fields, and error analyses
[JPRS-56099] N72-25430
Quantum interference fluxmeter with superconducting sensor having circuit loop with sharp constrictions, for measuring weak magnetic fields
N72-25431
Error analysis in measuring geomagnetic field components with self-oscillating quantum magnetometer with auxiliary alternating fields
N72-25433
Electrical and mechanical adjustments of quantum magnetometers for geomagnetic component measurement
N72-25434
Physical design principles of optically pumped magnetometers based on orientation of atomic moments by polarized light, for measuring very weak magnetic fields
N72-25438
Cesium Z-magnetometer for marine geomagnetic measurements onboard nonmagnetic schooner, and error analysis
N72-25439
Magnetic test facility used for magnetic field and torque measurements of UK 4 prototype spacecraft
[NASA-TM-X-65890] N72-25861

MAGNETIC STARS
Coriolis force effect on stability of rotating magnetic stars in hydrostatic equilibrium
[NASA-TM-X-65899] N72-25831

MAGNETIC STORMS
Particle pitch angle distribution and weak diffusion in plasma layer during magnetic substorm
[NASA-TT-F-14190] N72-25330
Effects of substorm activity, interplanetary magnetic field latitude, and dipole tilt angle on high-latitude precipitation of 700-eV electrons, determined from OGO 4 data
[NASA-TM-X-65902] N72-25832

MAGNETIC TAPES
Development and fabrication of long life magnetic tape for unattended operation in spacecraft tape recorders
[NASA-CR-122402] N72-25179

MAGNETIC VARIATIONS
Geomagnetic measurements in Spain for 1969
N72-25338

MAGNETIZATION
Improved orientation characteristics of quantum magnetometer with joint operation of radio frequency field and modulated optical pumping
N72-25436

MAGNETOHYDRODYNAMIC STABILITY
Effect of current and ion sound instability on plasma electrical conductivity in strong electric fields
[LA-TR-71-79] N72-25673
Wentzel-Kramer-Brillouin theory of Kelvin-Helmholtz instability in high beta collisionless plasmas
N72-25675
Abstracts and indexes on plasma instabilities
[AD-738218] N72-25676
Coriolis force effect on stability of rotating magnetic stars in hydrostatic equilibrium
[NASA-TM-X-65899] N72-25831

MAGNETOHYDRODYNAMIC WAVES
Magnetohydrodynamic waves near magnetopause
N72-25729

MAGNETOHYDRODYNAMICS
Effect of coriolis force on stability of rotating hydromagnetic systems and condition for instability
[NASA-TM-X-65908] N72-25826

MAGNETOMETERS
Magnetometer designs for measuring weak and very weak magnetic fields, and error analyses
[JPRS-56099] N72-25430
Quantum interference fluxmeter with superconducting sensor having circuit loop with sharp constrictions, for measuring weak magnetic fields
N72-25431
Self-oscillating magnetometer using linearly polarized light modified with Larmor precession frequency
N72-25432
Error analysis in measuring geomagnetic field components with self-oscillating quantum magnetometer with auxiliary alternating fields
N72-25433
Electrical and mechanical adjustments of quantum magnetometers for geomagnetic component measurement
N72-25434
Approximate compensation in airborne magnetometry for changing inductive field of aircraft moving through varying geomagnetic field
N72-25435
Improved orientation characteristics of quantum magnetometer with joint operation of radio frequency field and modulated optical pumping
N72-25436
Analysis of errors of quantum magnetometer in measuring inclination and declination
N72-25437
Physical design principles of optically pumped magnetometers based on orientation of atomic moments by polarized light, for measuring very weak magnetic fields
N72-25438
Cesium Z-magnetometer for marine geomagnetic measurements onboard nonmagnetic schooner, and error analysis
N72-25439
Development and characteristics of magnetometer with single Bi2Se3 crystal as sensing element
[NASA-CASE-LEW-11632-1] N72-25440

MAGNETOPAUSE
Magnetohydrodynamic waves near magnetopause
N72-25729

MAGNETOSPHERE
Mathematical models for calculating drift paths of low energy plasma flow in magnetosphere
N72-25325
Electric current production in magnetosphere and energy transfer from solar wind to magnetosphere
[NASA-TM-X-65893] N72-25340
Geomagnetic tail noise caused by electron instability in neutral sheet
[AD-738316] N72-25398
Barium cloud tracking and floating potential measurement for magnetospheric electric fields
[NASA-TM-X-65895] N72-25829

MAGNETOSPHERIC INSTABILITY
Effect of ring currents on magnetospheric distortion - OGO 3 and 5 observations
[NASA-TM-X-65904] N72-25630

MAGNETS
Magnets as navigation aids to homing pigeons
N72-25098
Residual field theory for superconducting dipoles and quadrupole magnets
[KFK-EXT-3/71-10] N72-25695

MAMMALS
Echolocation mechanisms in marine mammals
N72-25086

MANAGEMENT METHODS
Radioactive waste management and wholesomeness of irradiated foodstuffs
[TID-25940] N72-25617
Comparison of risk and benefits in management decision making policies
N72-25962
Methodological approach to managing system safety
N72-25972
Use of management techniques and modern safety engineering to achieve safety requirements in contractual agreements
N72-25973
Safety procedures for manned and unmanned spacecraft
N72-25979

MANAGEMENT PLANNING
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 1
N72-25936
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 2
N72-25937
Applications of nonlinear programming to military technology, management planning, decision theory, and defense systems
[AD-738118] N72-25991

MANAGEMENT SYSTEMS
Papers presented at conference on system safety in government and industry
[NASA-TM-X-68369] N72-25961
Factors causing system safety programs to fail
N72-25966

MANDELSTAM REPRESENTATION
Calculation of pion-Pomeranchon Regge cut from Mandelstam diagram for three pion exchange processes
[ILL-[TH]-72-5] N72-25642

MANEUVERABILITY
Analysis of effects of aircraft maneuvers on characteristics of sonic boom and application of analysis method to various aircraft - Vol. I
[AD-735296] N72-25011

MANNED SPACE FLIGHT
Development of computer program to describe uplink and downlink digital systems for manned spacecraft orbital missions - Vol. 2
[NASA-CR-115663] N72-25604
Appropriations for NASA manned space flight program during 1973
N72-25938

MANNED SPACECRAFT
Development of collapsible transparent observation window for manned spacecraft
[NASA-CR-112085] N72-25852

MANUAL CONTROL
Modification of manually operated fuel-cell system to provide monitoring and control by digital computer
[NASA-TM-X-2575] N72-25025
Automatic and manual checkout equipment for testing space vehicle signal transmission lines
[NASA-CASE-KSC-10385] N72-25211

MANUALS
Operation manual for oligatomic computer storage device
[NASA-CR-123634] N72-25215
Programmer manual for SEL 840MP multiprocessing control system
[NASA-CR-123559] N72-25216
Systems manual for GE 635 computer
[NASA-CR-126770] N72-25218
General principles and detailed procedures on lapping, gluing, and polishing of ultrathin samples of lunar rocks and particulates - manuals
[NASA-CR-115554] N72-25744

MANY BODY PROBLEM
Green function method and quasi-electrons in quantum mechanical multiple particle models
[DISS-4705] N72-25163

MAPPING
Contouring algorithms over triangular meshes for contour map making
[NPL-NAC-10] N72-25245

MARINE BIOLOGY
Design and development of remote sensors for oceanographic experiments on marine biology and thermal pollution
[AD-737348] N72-25405

MARINER VENUS-MERCURY 1973
Modulo-M counter for digital subsystem for generating spacecraft timing and control signals
[NASA-CR-126971] N72-25276

MARINER 9 SPACE PROBE
Telecommunications system design for Mariner Mars 1971 spacecraft, emphasizing modifications to accommodate orbital mission
[NASA-CR-126968] N72-25192

MARS LANDING
Analytical models for analyzing probable terrestrial microbial release from unmanned Mars landing spacecraft
[NASA-CR-126846] N72-25105

MASERS
Cavity resonator for hydrogen maser
[NASA-CASE-HQN-10790-1] N72-25491

MASKING
Fabrication of miniature electronic equipment by masking and superposition of layers using electron bombardment and ion injection
N72-25283

MASS SPECTROMETERS
Performance tests of lunar mass spectrometer designed to sample and measure gases in lunar atmosphere at surface
[NASA-CR-126772] N72-25429
Mass spectrometry measurements of hypersonic flow in shock tubes
[ISL-37/71] N72-25444

MATERIALS HANDLING
Design and characteristics of mechanically extended and telescoping boom on crane assembly
[NASA-CASE-NPO-11118] N72-25021

MATERIALS TESTS
Analysis of physical properties of materials to determine correlation with resistance to corrosion
[AD-738162] N72-25537
Development of computer program for cyclic deformation and fatigue properties of materials under axial and flexural conditions
[TN-4] N72-25892
Development of apparatus for testing burning rate and flammability of materials
[NASA-CASE-XMS-09690] N72-25913

MATHEMATICAL MODELS
Vortex model for calculating airstream at rotor blade of helicopter
[NASA-TT-F-14228] N72-24990
Dynamic theory of flutter for rotation of rigid wing
[ARL/SM-332] N72-24996
Development of mathematical model for evaluating compatibility of flight crew personnel and aircraft crew stations - Vol. 4
[AD-738008] N72-25017
Mathematical models for describing pilot performance during multiple input-output controller tasks
[NASA-CR-112048] N72-25128
Mathematic modeling, automata theory, speech synthesis, and mechanical model of heart and lungs
[JPRS-56072] N72-25135
Statistical modeling for predicting events and trends of complex systems
N72-25136
Axiomatic designations of logic differential equations used in modeling dynamic systems
N72-25137
Mathematical model of impact between finite cylindrical free jet and rigid smooth wall
[PB-206912] N72-25322
Mathematical models for calculating drift paths of low energy plasma flow in magnetosphere
N72-25325
Water quality simulation model for well-mixed estuaries and coastal seas
[P-4772-1] N72-25332
One-dimensional model for vertical diffusion of radon in 1 to 20 km region
[UILU-ENG-72-2501] N72-25337
Mathematical models for determining teleseismic travel time
[AD-737405] N72-25404
Mathematical models for analyzing quasi-one-dimensional flow across face seals and narrow slots of turbine engines
[NASA-TN-D-6668] N72-25468
Mathematical model for magnesium fluoride degradation due to electron irradiation
[ONERA-DERTS-NT-02-29] N72-25553
Principles of theory of categories with models and coalgebraic functions
[DISS-4670] N72-25572
Statistical method for objectively producing forecasts of daily maximum temperatures from numerical model output
[NOAA-TM-NWS-TDL-45] N72-25581
Simulated towed cable systems of nylon and steel strands, and two mathematical models for towline performance
N72-25730
Evolution of stellar models with helium envelopes
N72-25733
Numerical integration and analytical models for computing Vanguard 2 orbit
N72-25757
Optimization technique, problem formulation, and results obtained in design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123644] N72-25843
Mathematical models used in application of modern optimal control techniques to design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123645] N72-25844
Methods for analysis of random effects in spacecraft control systems and for evaluating system precision
[JPRS-56134] N72-25868
Analysis method for random parametric effects in spacecraft control systems
N72-25869
Methods for evaluating precision of spacecraft control systems operating under influence of large number of perturbations
N72-25870
Mathematical model of Kelvin-Voigt viscoelastic material and influence of internal damping
[REPT-110] N72-25895

MATRICES [MATHEMATICS]
Invariant coefficients of characteristic polynomial for n X n matrix
[NASA-TM-X-65885] N72-25562
Construction of matrices for Poisson equation using method of integral relations
N72-25573

MATRIX METHODS
Algorithm for calculating eigenvalues in quotient-difference transformation of tridiagonal matrix
[DISS-4624] N72-25568

MAXWELL EQUATION
Maxwell stress function solution for three dimensional elasticity problem
[REPT-79] N72-25888

MEASUREMENT
Developments in measurement technology
[NASA-SP-5926[02]] N72-25421

MEASURING INSTRUMENTS
Active and passive systems for detecting and measuring air movements with wingtip vortex generation
[DOT-TSC-FAA-72-13] N72-25313

MECHANICAL DEVICES
Mechanical heart and lungs system, with hypothetical polymer deformable upon contact with blood
N72-25140
Characteristics of lightweight actuator for imparting linear motion using elongated output shaft
[NASA-CASE-NPO-11222] N72-25456

MECHANICAL DRIVES
Wheel with omnidirectional movement provided by independent drives for rim elements
[NASA-CASE-MFS-21309-1] N72-25480
Actuator with integrated motor and epicyclic gear reducer for space missions
N72-25765

MECHANICAL ENGINEERING
Mechanics, acoustics, ultrasonics, radio, and structural engineering research
N72-25626

MECHANICAL MEASUREMENT
Development of Hall effect transducer for converting mechanical shaft rotations into proportional electrical signals
[NASA-CASE-LAR-10620-1] N72-25255

MECHANICAL PROPERTIES
Generalization of Hamiltonian and bilinear functional for nonself-adjoint mechanical systems
[REPT-64] N72-25459
Mechanical behavior of fine soils in lunar environment in engineering gravity flow bins
[BM-RI-7543] N72-25472
Low temperature ductility and mechanical properties of molybdenum and molybdenum-rhenium alloys
[NASA-TM-X-2576] N72-25523
Thermomechanical and thermochemical behavior of high temperature, oxidation resistant, hafnium-20 percent tantalum alloy
[NASA-TM-X-68339] N72-25524
Mechanical behavior of alloys and metals during high temperature deformation
[REPT-108] N72-25681

MEDICAL EQUIPMENT
Tilting table for testing human body in variety of positions while exercising on ergometer or other biomedical devices
[NASA-CASE-MFS-21010-1] N72-25127
Automatic system for measuring and monitoring systolic and diastolic blood pressure in humans
[NASA-CASE-MSC-13999-1] N72-25142
MEDICINE
Defense, medical and industrial research in Canada for 1971
[DR-214] N72-25930
MEMBRANES
Metallic osmotic membranes for desalinization of sea water
[CEA-R-4129] N72-25533
MENTAL PERFORMANCE
Diver performance in manual and mental tasks at 66 feet
[AD-737376] N72-25116
Effect of auditory distraction on Stroop color-word interference performance tests
[FAA-AM-72-14] N72-25132
MERCURY [METAL]
Effects of Gibbsian adsorbed layers and insolubie films on film forming mechanism of liquid mercury surfaces
[NASA-CR-120884] N72-25158
MERCURY OXIDES
Design and fabrication of mercuric oxide-cadmium batteries to provide increased shelf life and low temperature operating capability
[AD-736769] N72-25028
MESH
Contouring algorithms over triangular meshes for contour map making
[NPL-NAC-10] N72-25245
METAL BONDING
Bonding tests of weldment filling in forged steel axle
[TR-7103.494] N72-25463
METAL COATINGS
Polymeric film-metal-film sandwich laminate for reduced permeability material of cryogenic expulsion bladder
[NASA-CR-120892] N72-25159
Selective nickel deposition on irradiation sensitive compounds
[NASA-CASE-LEW-10965-1] N72-25452
Proceedings of conference on sputtering and ion plating
[NASA-SP-5111] N72-25470
Intermetallic coating for nickel based superalloy
[NASA-CASE-LEW-11348-1] N72-25517
Effects of production methods on residual stresses in austenite plated steel sheets
N72-25526
Proceedings of conference on electrodeposited materials to describe properties and applications
[AD-738272] N72-25536
Edge and surface modification of niobium alloys, silicon coating, and slurry composition modification
[NASA-TM-X-68052] N72-25543
METAL CRYSTALS
Phase stability of bond type metallic binary systems
[NPL-DCS-15] N72-25697
METAL FATIGUE
Mechanical behavior of alloys and metals during high temperature deformation
[REPT-108] N72-25681
METAL FILMS
Metallic osmotic membranes for desalinization of sea water
[CEA-R-4129] N72-25533
METAL PLATES
Development of theory for interfacial thermal conductance between two heated metal plates in direct contact
[NASA-CR-126743] N72-25921
METAL SHEETS
Effects of production methods on residual stresses in austenite plated steel sheets
N72-25526
METAL SURFACES
Chemisorption of Co on tungsten III surface
N72-25157
Effects of Gibbsian adsorbed layers and insoluble films on film forming mechanism of liquid mercury surfaces
[NASA-CR-120884] N72-25158
METALS
Process for depositing pure metals by irradiating liquids
[NASA-CASE-LEW-10906-1] N72-25164
Solidification time of metal drops in vacuum, considering heat removal by radiation and evaporation
[RM-544] N72-25532
Analysis of physical properties of materials to determine correlation with resistance to corrosion
[AD-738162] N72-25537
Inelastic behavior of metals subjected to various types of loads
[AD-738326] N72-25538
Proximity effects for superconducting and normal metals
[NASA-CR-126771] N72-25682
Methods of attaining sufficient pressure for metallic hydrogen at room temperature
[JPRS-56130] N72-25692
METEORITES
Nondestructive gamma-gamma coincidence counting, radiochemical, and substoichiometric separation methods for determination of noble metals in meteorites
N72-25511
METEORITIC COMPOSITION
Mineralogical composition of fusion crust of Kunashak stony meteorite
[NASA-TT-F-14269] N72-25752
METEOROIDS
Velocity and mass flux, physical characteristics, and classification and relation to comets of radio and radar meteors - overview
[NASA-CR-112639] N72-25808
METEOROLOGICAL BALLOONS
Eole monitoring of drifting buoys and balloons in Southern Hemisphere for oceanographic and meteorological data
[NASA-TT-F-14279] N72-25345
Nimbus 4 interrogation, recording, and location system for data collection from remote atmospheric sounding balloons
N72-25777
METEOROLOGICAL CHARTS
Synoptic meteorological weather charts of Northern Hemisphere for November, 1971
N72-25576
METEOROLOGICAL INSTRUMENTS
Results and future trends of laboratory microbarograph system
[REPT-327] N72-25388
METEOROLOGICAL PARAMETERS
Radar observations of passerine birds to determine effects of wind and meteorological parameters on migratory behavior
N72-25071
Conference papers dealing with remote probe techniques for observing and measuring physical composition and dynamical structure of atmosphere
[NASA-CR-126787] N72-25347
Feasibility of line-of-sight microwave propagation experiments in analyzing significant meteorological problems
N72-25348
Atmospheric absorption measurements for meteorological research using microwave transmissions from satellite beacons
N72-25351
Applying Doppler techniques to studying atmospheric phenomena
N72-25364
Meteorological parameter effects on passive remote sensing at microwave wavelength
N72-25373
Observation methods and properties of sferics including meteorological implications
N72-25383
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for July 1971
N72-25578
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for Aug. 1971
N72-25579
Aerological data from balloon and rocket flights for Japan and its vicinity - tables for Sept. 1971
N72-25580
Utilization of satellite meteorological observations for climatological research
[NASA-TT-F-723] N72-25582
Handbook for coding radiosonde reports by U.S. weather stations
N72-25587
Coastal marine meteorological parameters for southwestern Asia
[AD-737909] N72-25592
METEOROLOGICAL SATELLITES
NOAA satellite observations and ground support at research and data processing facilities - 1971
N72-25806
METEOROLOGY
International cooperation and voluntary assistance in meteorological projects in 1971
[WMO-323] N72-25591
METHANE
Vertical distribution of stratospheric methane by balloon-borne infrared spectrometers
[AERONOMICA-ACTA-A-97-1972] N72-25837
METHYL COMPOUNDS
Effects of toxic methyl isobutyl ketone vapor on physiological processes in dogs, monkeys, and rats during 90 day continuous exposure
[NASA-CR-126744] N72-25102
METRIC SPACE
Orthogonal collineation for formulating metric planes by transformation axioms
N72-25564
METROLOGY
Findings of US government study group on advantages and problems associated with converting industry and science to metric system of measurements
N72-25469
MICROBIOLOGY
Development of variable angle device for positioning test tubes to permit optimum drying of culture medium
[NASA-CASE-LAR-10507-1] N72-25284
MICROFILMS
High speed microfilm plotter for data recording, emphasing software packages
N72-25235
MICROMINIATURIZATION
Development of miniature electronic transmitters and application for monitoring biological and physiological activities
[NASA-CR-127047] N72-25191
MICROORGANISMS
Analytical models for analyzing probable terrestrial microbial release from unmanned Mars landing spacecraft
[NASA-CR-126846] N72-25105
MICROSTRUCTURE
Microstructure of superplastic micrograin aluminum bronze
[REPT-93] N72-25514
Creep, tensile and thermal properties, and microstructure of Zn-Al alloys
[BM-RI-7538] N72-25518
MICROWAVE ANTENNAS
Multipurpose microwave antenna, employing dish reflector with plural coaxial horn feeds
[NASA-CASE-NPO-11264] N72-25174
Omnidirectional antenna array with circumferential slots for mounting on cylindrical space vehicle
[NASA-CASE-LAR-10163-1] N72-25247
MICROWAVE CIRCUITS
Microwave circuit for measuring complex dielectric constant of polar liquid by cavity perturbation method
[NOTA-INTERNA-352] N72-25637
MICROWAVE EMISSION
Transport properties and microwave emission in n-type InSb at liquid nitrogen temperature
N72-25684
MICROWAVE EQUIPMENT
Linear statistical inversion from ground based microwave probing
N72-25372
MICROWAVE RESONANCE
Bremsstrahlung X rays, optical diagnostics, and microwave calculations
[COO-1695-39] N72-25671
MICROWAVE SPECTRA
Research on molecular beams, microwave spectroscopy, atomic resonance and scattering
[AD-737814] N72-25840
MICROWAVE TRANSMISSION
Feasibility of line-of-sight microwave propagation experiments in analyzing significant meteorological problems
N72-25348
Line-of-sight methodology used with microwave propagation in remote atmospheric probing
N72-25350
Atmospheric absorption measurements for meteorological research using microwave transmissions from satellite beacons
N72-25351
MICROWAVES
Two atmospheric probing experiments, involving beyond-the-horizon propagation of microwave signals
N72-25368
Absorption spectra of ground based passive microwave radiometric probing of atmosphere
N72-25371
Meteorological parameter effects on passive remote sensing at microwave wavelength
N72-25373
Performance and problems of microwave guidance systems for aircraft approach and landing
[RAE-TR-71186] N72-25606
MIDDLE EAR
Effect of middle ear muscle contractions on hearing and echo processing in Mustache Bat
N72-25084
MIE SCATTERING
Multiple scattering of polarized light using doubling method
[NASA-CR-126753] N72-25624
MIGRATION
Application of tracking radar for determining flight paths of migratory birds
N72-25069
Radar and visual tracking of migratory birds to determine correlation of flight altitude and wind direction on direction of migration
N72-25070
Radar observations of passerine birds to determine effects of wind and meteorological parameters on migratory behavior
N72-25071
Radar observations of migratory birds to determine effects of weather conditions on migration behavior
N72-25072
Radar observations of birds migrating in opaque cloud cover to determine effects of wind and meteorological conditions
N72-25073

Orientation of nocturnally migrating birds based on reference to stellar positions and sky rotation N72-25074
Analysis of pattern recognition capability of migratory birds and manner of orientation with stellar presentations N72-25075
Analysis of cues used by migratory birds for navigation and orientation N72-25076
Environmental and endogenous timing factors as stimuli for bird migration N72-25082
Factors affecting migratory habits and orientation of sea turtles N72-25091
Use of magnetic cues to select migratory direction by European robins N72-25097

MILITARY AIRCRAFT
Analysis of military aircraft accidents caused by spatial disorientation N72-25034
Statistical analysis of military aircraft accidents to determine incidents caused by spatial disorientation N72-25035
Psychophysiological and environmental factors involved in aircraft accidents of military aircraft and effect of flying experience in reducing spatial disorientation N72-25036
Quality control tests on high velocity aircraft rockets and their ignition characteristics [TL-1971-7] N72-25849
Senate report on transportation of Government civil and military passengers and cargo by civil and military air carriers [S-REPT-92-503] N72-25948

MILITARY TECHNOLOGY
Physical characteristics, and system effectiveness of high power airborne military illuminating sources [AD-737832] N72-25678
Applications of nonlinear programming to military technology, management planning, decision theory, and defense systems [AD-738118] N72-25991

MILKY WAY GALAXY
Characteristics of faint stars at high galactic latitudes determined by UBV photometry N72-25417
Distribution of cosmic ray sources, map of sky, and model of galactic field N72-25717

MILLIMETER WAVES
Analysis of performance of path diversity satellite-to-ground millimeter wave link [NASA-CR-122395] N72-25180

MINERALOGY
Mineralogical composition of fusion crust of Kunashak stony meteorite [NASA-TT-F-14269] N72-25752

MINIATURE ELECTRONIC EQUIPMENT
Fabrication of miniature electronic equipment by masking and superposition of layers using electron bombardment and ion injection N72-25283

MINIMAX TECHNIQUE
Minimax solution of second order phase lock loop acquisition by computerized simulation N72-25555

MINITRACK SYSTEM
Parameter effects on short arc satellite survey adjustments and GEOS I minitrack observations [NASA-TM-X-65896] N72-25830

MISSILE TRAJECTORIES
Analysis of proportional navigation system used for missile guidance and comparison with theoretical system [AASU-313] N72-25597

MISSION PLANNING
Telecommunications system design for Mariner Mars 1971 spacecraft, emphasizing modifications to accommodate orbital mission [NASA-CR-126968] N72-25192
Real time auxiliary computing facility for carrying out mission support and simulation programs during Apollo project [NASA-TN-D-6855] N72-25223
Use of computer programs as navigation aid during contingency lunar mission planning [NASA-TN-D-6853] N72-25600
Apollo mission planning for lunar module descent and ascent based on postflight analysis of previous missions [NASA-TN-D-6846] N72-25855

MIST
Method of measuring mist droplets by size and number [RAE-LIB-TRANS-1627] N72-25302

MOLECULAR BEAMS
Research on molecular beams, microwave spectroscopy, atomic resonance and scattering [AD-737814] N72-25840

MOLECULAR COLLISIONS
Proving of Boltzmann limit conjecture for two- and three-dimensional Lorentz gas with hard core molecular collisions [NOTA-INTERNA-358] N72-25638
Influence of multipole interactions on rotational energy exchange in molecular collisions [NASA-CR-126729] N72-25639

MOLECULAR DIFFUSION
Numerical analysis of diffusion coefficients and characteristics of diffusion, adsorption, and reaction type processes [DISS-4746] N72-25162
One-dimensional model for vertical diffusion of radon in 1 to 20 km region [UILU-ENG-72-2501] N72-25337
Effect of grain boundary increase and intragrain defects in austenite structure on carbon diffusion [NASA-TT-F-14272] N72-25516

MOLECULAR RELAXATION
Molecular relaxation equilibrium conditions behind reflected shock waves with tables for carbon dioxide and nitrous oxide [ARC-CP-1201] N72-25316

MOLECULAR ROTATION
Spectrometer with superheterodyne receiver for high resolution electron paramagnetic and molecular rotation-spectroscopy [DISS-4673] N72-25272
Influence of multipole interactions on rotational energy exchange in molecular collisions [NASA-CR-126729] N72-25639

MOLECULAR SPECTRA
Listing of infrared molecular spectra and laboratory conditions [NASA-CR-126985] N72-25648

MOLECULAR STRUCTURE
Organic structure of aromatic compounds after photoionic and photosensitive dissociation N72-25156

MOLYBDENUM
Low temperature ductility and mechanical properties of molybdenum and molybdenum-rhenium alloys [NASA-TM-X-2576] N72-25523

MOLYBDENUM ALLOYS
Low temperature ductility and mechanical properties of molybdenum and molybdenum-rhenium alloys [NASA-TM-X-2576] N72-25523

MOMENTS
Computer code for generating spatial-angular moments of neutron flux in infinite medium [NBS-TN-725] N72-25227

MONITORS
Application of Doppler effect and artificial satellite coverage for tracking wild animals N72-25063
Development and application of instrumentation for tracking movements of sea turtles and polar bears N72-25064

MOTION SICKNESS
Development of theory concerning human reactions to whole body motion and explanation of individual differences to motion effects N72-25044

MOTION SICKNESS DRUGS
Effectiveness of benactyzine hydrochloride and other antimotion sickness drugs combined with scopolamine [AD-737220] N72-25118

MOVING TARGET INDICATORS
Digital processors for improving optimum performance of MTI [AD-738298] N72-25201

MULTICHANNEL COMMUNICATION
Characteristics of multichannel radar system and specific application for solution of radar tracking problems N72-25197

MULTIPLE DOCKING ADAPTERS
Multiple in-line docking capability having intermeshing docking turrets for rotating space stations [NASA-CASE-MFS-20855-1] N72-25853

MULTIPLEXING
Development and characteristics of television multiplexing system using single crystal controlled clock for synchronization of signals [NASA-CASE-KSC-10654-1] N72-25184

MULTIPOLES
Influence of multipole interactions on rotational energy exchange in molecular collisions [NASA-CR-126729] N72-25639

MULTIPROGRAMMING
Programmer manual for SEL 840MP multiprocessing control system [NASA-CR-123559] N72-25216
Generation and operational use of multiprogramming system [NASA-CR-126668] N72-25217
Computer development, noting improvements by multiprogramming, buffer stores, and software evolution N72-25234

MULTISPECTRAL BAND SCANNERS
Design and operation of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements [NASA-CR-126721] N72-25334
Breadboard tests of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements [NASA-CR-126722] N72-25335
Design of multispectral infrared line scanner for use on space shuttle earth resources mission, noting equipment specifications [REPT-779/72/1-VOL-1] N72-25445
Design of multispectral infrared line scanner for use on a space shuttle earth resources mission [REPT-779/72/1-VOL-2-SUMM] N72-25446

MULTISPECTRAL PHOTOGRAPHY
Image dissector camera system for high resolution multispectral imagery N72-25781

MULTIVARIATE STATISTICAL ANALYSIS
Multivariate approaches to pattern recognition and dyspepsia cures [AD-737268] N72-25117

N

N-TYPE SEMICONDUCTORS
Transport properties and microwave emission in n-type InSb at liquid nitrogen temperature N72-25684

NARCOSIS
Visual evoked response as measure of nitrogen narcosis in divers breathing compressed air from 0 to 250 feet [AD-737208] N72-25114

NASA PROGRAMS
Proposed NASA experiment for spaceborne clock system to develop new atomic frequency standards technology and improve international time and frequency comparisons [NASA-CR-122394] N72-25423
Nondestructive testing technology transfer based on information obtained from NASA reliability engineering programs [NASA-CR-126574] N72-25482
NASA budget authorization for 1973 [S-REPT-92-779] N72-25933
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 1 N72-25936
Hearings of Committee on Aeronautical and Space Sciences of US Senate to determine NASA authorization for fiscal year 1973 - Part 2 N72-25937
Appropriations for NASA manned space flight program during 1973 N72-25938
Congressional hearings on 1973 budget request by NASA N72-25939
Identification of NASA contributions to advancement of major developments in selected fields of technology - Vol. 1 [NASA-CR-126561] N72-25953
Contributions of NASA programs to specific fields of technology - Vol. 2 [NASA-CR-126562] N72-25954

NATURAL GAS
Research projects in energy sources, energy development, and exploitation [ORNL-EIS-72-18-VOL-1] N72-25635

NAVIGATION
Proceedings of conference on animal orientation and navigation capabilities [NASA-SP-262] N72-25062
Radar and visual tracking of migratory birds to determine correlation of flight altitude and wind direction on direction of migration N72-25070
Analysis of cues used by migratory birds for navigation and orientation N72-25076
Analysis of effects of topography on homing ability of pigeons as determined by ground release and helicopter tracking N72-25077
Effects of clock shift on orientation of migratory birds and deviations in initial orientation produced by varying amounts of clock shift N72-25078
Analysis of cues used by homing pigeons with emphasis on effects of sun location and magnetic fields N72-25079
Light source position measuring mechanism of homing pigeons N72-25080
Anatomical function of spermaceti organ in sperm whales [CONTRIB-74] N72-25087

NAVIGATION AIDS
Function of visual cues in orientation navigation systems of desert ants N72-25088
Use of sunlight as underwater visual direction finder by fishes N72-25089
Factors affecting migratory habits and orientation of sea turtles N72-25091
Use of magnetic cues to select migratory direction by European robins N72-25097
Magnets as navigation aids to homing pigeons N72-25098
Use of computer programs as navigation aid during contingency lunar mission planning
[NASA-TN-D-6853] N72-25600
Requirements for channel splitting to accommodate increased VHF omnirange navigation instrument landing systems, and distance measuring equipment facilities
[PAPER-54-71/SC122-3] N72-25602

NAVIGATION INSTRUMENTS
Development of experiments for testing inertial instruments in drag-free satellite
[AD-738309] N72-25608

NAVIGATION SATELLITES
Analysis of navigation concept with single radiating interferometer on spinning synchronous satellite N72-25596

NEBULAE
Formaldehyde emission and H2CO absorption in Orion nebula
[NASA-TM-X-65897] N72-25342
Cosmic abundance of He-3 isotope determined from hyperfine radiation in galactic diffuse nebulae N72-25741
Star formation from galactic clouds
[REPT-101] N72-25749
Theories of solar system origin, emphasizing primitive nebula and accretion N72-25821

NEPTUNE [PLANET]
Interior structure of Jupiter and other giant planets N72-25818

NETWORK ANALYSIS
Numerical analysis of torsion decomposition of finite CW-Complexes
[DISS-4460] N72-25567
Development of system for automatic time synchronization based on Loran system timing networks
[RR-104] N72-25598

NEURONS
Clinical electrodiagnosis in prognosis of lower motor neuron lesions N72-25058

NEUROPHYSIOLOGY
Neurophysiological analysis of echolocation and signal processing in bats N72-25083

NEUTRON ACTIVATION ANALYSIS
Neutron activation data for Apollo 12 rocks and soils
[NASA-CR-115570] N72-25754

NEUTRON FLUX DENSITY
Computer code for generating spatial-angular moments of neutron flux in infinite medium
[NBS-TN-725] N72-25227

NICKEL
Strain gage data and techniques for D-38 test beams electroplated with nickel and gold
[UCRL-51169] N72-25443
Selective nickel deposition on irradiation sensitive compounds
[NASA-CASE-LEW-10965-1] N72-25452

NICKEL ALLOYS
Corrosion resistance of cold worked austenitic CrNi steels and Ni alloys in superheated steam
[EURFNR-954] N72-25534
Thermal compatibility of production grade [Pu-238]O2 and nickel and cobalt base alloys
[MLM-1864] N72-25535

NICKEL CADMIUM BATTERIES
Weight screening method for optimum selection of nickel and cadmium cell plates N72-25768

NICKEL COMPOUNDS
Method for processing and plating helical coil with nickel cobalt
[NASA-CR-122418] N72-25478

NIMBUS SATELLITES
Discrete component amplifier for superhigh frequencies N72-25773

NIMBUS 4 SATELLITE
Nimbus 4 interrogation, recording, and location system for data collection from remote atmospheric sounding balloons N72-25777

NIOBIUM ALLOYS
Edge and surface modification of niobium alloys, silicon coating, and slurry composition modification
[NASA-TM-X-68052] N72-25543

NITROAMINES
Mercaptan terminated polymer containing sulfonic acid salts of nitrosubstituted aromatic amines for heat and moisture resistant coatings
[NASA-CASE-ARC-10325] N72-25147

NITROGEN
Fabrication and operational procedures for processing lunar samples in sterile nitrogen atmosphere
[NASA-TN-D-6858] N72-25099
Visual evoked response as measure of nitrogen narcosis in divers breathing compressed air from 0 to 250 feet
[AD-737208] N72-25114
Origin of satellite/resonance lines of boron, carbon, and nitrogen ions
[NASA-TM-X-68338] N72-25649
Radiative heat transfer effects behind reflected shock waves in air and nitrogen
[NASA-CR-126726] N72-25917

NITROGEN DIOXIDE
High altitude balloon flights to measure SO2 and NO2 gases in earth atmosphere using absorption spectroscopy
[NASA-CR-115639] N72-25343

NITROGUANIDINE
Solid propellant stabilizer containing nitroguanidine
[NASA-CASE-NPO-12000] N72-25699

NITROUS OXIDES
Infrared absorption properties of N2O from 760 to 2380/cm
[AD-737839] N72-25169
Molecular relaxation equilibrium conditions behind reflected shock waves with tables for carbon dioxide and nitrous oxide
[ARC-CP-1201] N72-25316

NOBLE METALS
Nondestructive gamma-gamma coincidence counting, radiochemical, and substoichiometric separation methods for determination of noble metals in meteorites N72-25511

NOISE [SOUND]
Human factors engineering to determine effects of weapon noise on military personnel and development of criteria for performance prediction of personnel after exposure to noise
[AD-738135] N72-25145

NOISE INTENSITY
Effects of high intensity noise levels on human vestibular system and production of disorientation and nausea
[AMRL-TR-71-58] N72-25038
Noise level measurements, and octave band analysis for large maritime type diesel engine operating under full-load conditions
[TR-7202.564] N72-25622

NOISE POLLUTION
Noise levels and spectral analysis for Vidraria Company in Sao Paulo, Brazil
[TR-7201.561] N72-25620

NOISE PROPAGATION
Theoretical acoustics applied to jet engine noise generation, propagation, and reduction studies N72-25632

NOISE REDUCTION
Characteristics of noise immune switching gates with hysteresis loops N72-25266
Piecewise cross correlation technique for analyzing outputs of remote detection devices to eliminate noise from optical background fluctuations N72-25381
Acoustic survey of noise levels in Colegio Objetivo
[TR-7111.549] N72-25621
Theoretical acoustics applied to jet engine noise generation, propagation, and reduction studies N72-25632
Vibration mode and noise spectra of rotating disks including noise reduction of circular saws
[INRS-14/RE-A] N72-25908

NOISE SPECTRA
Method for computing noise generated by standing and flying jet aircraft
[ONERA-NT-187] N72-25636

NONDESTRUCTIVE TESTS
Ultrasonic inspection of wing spar joints on Viscount aircraft
[TR-7105.512] N72-25461
Nondestructive testing technology transfer based on information obtained from NASA reliability engineering programs
[NASA-CR-126574] N72-25482
Nondestructive gamma-gamma coincidence counting, radiochemical, and substoichiometric separation methods for determination of noble metals in meteorites N72-25511

NONEQUILIBRIUM FLOW
Nonequilibrium dissociated oxygen flow generated by shock wave in glow discharge tube N72-25295

NONLINEAR EQUATIONS
Solution to nonlinear equations of motion for gas in solid propellant rocket engine N72-25914

NONLINEAR PROGRAMMING
Applications of nonlinear programming to military technology, management planning, decision theory, and defense systems
[AD-738118] N72-25991

NONLINEAR SYSTEMS
Nonlinear oscillations in automatic control systems
[AD-738124] N72-25574

NONUNIFORM FLOW
Numerical analysis of nonhomogeneous flow in two dimensional propulsive lifting system N72-25296

NORTHERN HEMISPHERE
Synoptic meteorological weather charts of Northern Hemisphere for November, 1971 N72-25576

NOSE WHEELS
Improved aircraft ground performance in slush and wet runway conditions by addition of extra nose wheel
[ARC-CP-1206] N72-25009

NOSES [FOREBODIES]
Measurement of base pressure fluctuations at subsonic and supersonic speeds on flared bodies with flat or hemispherical noses
[ARC-CP-1204] N72-24997

NOZZLE FLOW
Measurement of gas flows in far upstream region of small nozzles with large boundary layer flow
[NASA-CR-126967] N72-25309

NUCLEAR ELECTRIC POWER GENERATION
Performance of uranium nitride fueled converters with rhenium or tungsten emitters
[NASA-CR-126864] N72-25609
Nuclear energy systems for spacecraft power and propulsion
[NASA-TM-X-68341] N72-25612

NUCLEAR ENERGY
Nuclear energy systems for spacecraft power and propulsion
[NASA-TM-X-68341] N72-25612

NUCLEAR EXPLOSIONS
Underground nuclear explosion infrasonic frequency detection noting supersonic signals
[KGO-722] N72-25393

NUCLEAR FUEL ELEMENTS
Design and performance analyses of SNAP 199 fuel element core
[AI-AEC-13017] N72-25618

NUCLEAR FUELS
Performance of uranium nitride fueled converters with rhenium or tungsten emitters
[NASA-CR-126864] N72-25609
Research projects in energy sources, energy development, and exploitation
[ORNL-EIS-72-18-VOL-1] N72-25635

NUCLEAR MODELS
Elementary pion with transverse momentum cutoff and pion contribution to neutron spectra in high energy reactions
[NOTA-INTERNA-360] N72-25665

NUCLEAR PARTICLES
Radiation and chemical effects on totally depleted silicon diodes as nuclear particle detectors N72-25786

NUCLEAR PHYSICS
Nuclear research and development projects
[KFK-1550] N72-25989

NUCLEAR PROPULSION
Design and experimental performance of rotating fluidized bed reactor for use in nuclear propulsion systems
[NASA-CR-126738] N72-25611

NUCLEAR REACTOR CONTROL
Alternative schemes for providing closed loop reactor control in thermionic reactor systems
[NASA-CR-126868] N72-25610

NUCLEAR REACTORS
Safety procedures for operating nuclear reactors
[NP-19199] N72-25614
Engineering problems of RF heating fusion reactors below 100 MHz
[ORO-3778-5] N72-25615

NUCLEAR RESEARCH
Nuclear research and development projects
[KFK-1550] N72-25989

NUCLEAR ROCKET ENGINES
Completely modularized nuclear reactor powered ion propulsion system
[NASA-CR-126865] N72-25703
Analysis of requirements for thermionic reactor electric propulsion system
[NASA-CR-126867] N72-25704

NUCLEI [NUCLEAR PHYSICS]
Calculation of finite, nonspherical nuclear systems using BHF method to determine intrinsic spectra, radii, quadrupole moments, and hexadecapole moments
[NASA-TN-D-6834] N72-25646

NUCLEONS
Sigma value in pion-nucleon scattering and other low energy parameters
[ISS-71/20] N72-25652

NUMERICAL ANALYSIS
Numerical analysis of nonhomogeneous flow in two dimensional propulsive lifting system N72-25296

Development of convergent iteration procedure for determining roots of polynomials and computer program for machine calculation of complex series
[DISS-4653] N72-25566
Calculation of finite, nonspherical nuclear systems using BHF method to determine intrinsic spectra, radii, quadrupole moments, and hexadecapole moments
[NASA-TN-D-6834] N72-25646
Numerical analysis for optimal dimensions of semiconductors in cryogenic systems
[DISS-4656] N72-25690
Numerical algorithm for determining optimal plane changes of three impulse transfers between noncoplanar circular orbits
[NASA-TM-X-64662] N72-25809
Development of analytic model and procedure for estimating probability distributions of touchdown conditions for space shuttle orbiter vehicle
[NASA-CR-114465] N72-25875
JOSS - conversational computing system for computer novice
[R-918] N72-25935

NUMERICAL WEATHER FORECASTING
Analyzing use of infrared radiometry for remote atmospheric probing
N72-25378

NYSTAGMUS
Procedure for determining cases of mild intoxication based on postrotational fixation nystagmus
N72-25039
Alcohol-induced postrotatory fixational nystagmus and detection of alcohol intoxication in pilots
N72-25060

O

O STARS
Photometric and photographic data used to identify new faint blue stars and study longitudinal distributions of interstellar absorption, H I, and H II across Carina spiral feature
N72-25736

OAO
Designing three meter class large space telescopes
[NASA-TM-X-68824] N72-25422
Onboard stored program computer for OAO C
N72-25776
Stabilization and control test facility for OAO spacecraft
N72-25791

OBLATE SPHEROIDS
Rotation of deep solar interior based on observed oblateness, implied gravitational quadrupole moment, slow solar wind braking, and Li depletion and lack of Be depletion
N72-25812

OCCULTATION
Passive radio, radar, and radio occultation exploration of planets
N72-25819

OCEAN BOTTOM
Prototype tools and geophysical identification and classification of sea floor sediments
[AD-737282] N72-25406

OCEANOGRAPHY
Design and operation of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements
[NASA-CR-126721] N72-25334
Breadboard tests of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements
[NASA-CR-126722] N72-25335
Eole monitoring of drifting buoys and balloons in Southern Hemisphere for oceanographic and meteorological data
[NASA-TT-F-14279] N72-25345
Design and development of remote sensors for oceanographic experiments on marine biology and thermal pollution
[AD-737348] N72-25405
NOAA satellite observations and ground support at research and data processing facilities - 1971
N72-25806

OCEANS
Sea-air energy flux measurements from atmospheric budget, surface layer vertical eddy flux, and upper ocean heat budget data
[NOAA-TM-ERL-BOMAP-9] N72-25333
Cesium Z-magnetometer for marine geomagnetic measurements onboard nonmagnetic schooner, and error analysis
N72-25439
Coastal marine meteorological parameters for southwestern Asia
[AD-737909] N72-25592
Amended bill establishing National Advisory Committee on Oceans and Atmosphere
[S-REPT-92-333] N72-25947

OGO-C
Effect of ring currents on magnetospheric distortion - OGO 3 and 5 observations
[NASA-TM-X-65904] N72-25630

OGO-D
Proton events observed with OGO-D and some observed flux profiles
[NASA-CR-122360] N72-25727
Effects of substorm activity, interplanetary magnetic field latitude, and dipole tilt angle on high-latitude precipitation of 700-eV electrons, determined from OGO 4 data
[NASA-TM-X-65902] N72-25832

OGO-E
Effect of ring currents on magnetospheric distortion - OGO 3 and 5 observations
[NASA-TM-X-65904] N72-25630

OIL EXPLORATION
Applicability of NASA contract quality management and failure mode effect analysis procedures to USGS Outer Continental Shelf oil and gas lease management program
[NASA-TM-X-2567] N72-25955

OLFACTORY PERCEPTION
Olfactory stimuli and ultrasonic signal methods for individual recognition between mother and infant brown bats
N72-25085

OLIVINE
Crystal structure of olivine and polymorphism
[NASA-TT-F-14243] N72-25687

OMNIDIRECTIONAL ANTENNAS
Omnidirectional antenna array with circumferential slots for mounting on cylindrical space vehicle
[NASA-CASE-LAR-10163-1] N72-25247

ON-LINE PROGRAMMING
DARE 3, on-line time-shared all-digital simulation system
N72-25212
On-line programming uses for computer systems research
[NASA-CR-122427] N72-25224

ONBOARD EQUIPMENT
Onboard stored program computer for OAO C
N72-25776

ONE DIMENSIONAL FLOW
Mathematical models for analyzing quasi-one-dimensional flow across face seals and narrow slots of turbine engines
[NASA-TN-D-6668] N72-25468

OPERATING SYSTEMS [COMPUTERS]
Generation and operational use of multiprogramming system
[NASA-CR-126668] N72-25217

OPERATIONAL PROBLEMS
Systems analysis during operational phase
N72-25977

OPERATIONS RESEARCH
Discrete event simulation in operations research
[ETN-5] N72-25990
Applications of nonlinear programming to military technology, management planning, decision theory, and defense systems
[AD-738118] N72-25991

OPERATORS [MATHEMATICS]
Q operator formalism for determining D autoionization states of atomic He and ionic H
[NASA-TM-X-65898] N72-25647

OPTICAL DATA PROCESSING
Computer program for solving heat transfer problems by optical structural analysis
N72-25763

OPTICAL EQUIPMENT
Development of light sensing system for controlled orientation of object relative to sun or other light source
[NASA-CASE-NPO-11311] N72-25414
Comparison of coherent and conventional light sources to show advantages of coherent light for optical experiments
N72-25497

OPTICAL MEASUREMENT
Remote sensing of optical effects arising from refractive index variations of clear atmosphere by ground-to-ground line-of-sight optical methods
N72-25352
Optical measurements of magnitude of scintillation as function of range and refractive index structure coefficient in near earth environment
N72-25354
Remote probing of optical strength of atmospheric turbulence and of wind velocity at various altitudes by measuring spatial and temporal covariance of scintillation
N72-25356

OPTICAL PATHS
Local isotropy and turbulent fluctuations of refractive index in surface layer of atmosphere
N72-25353

OPTICAL PROPERTIES
Development of light sensing system for controlled orientation of object relative to sun or other light source
[NASA-CASE-NPO-11311] N72-25414
Comparison of coherent and conventional light sources to show advantages of coherent light for optical experiments
N72-25497
Application of aerodynamic holography for optical recording and flow visualization in wind tunnels and research facilities
N72-25498
Computerized simulation of X ray telescope geometrical optics
N72-25780

OPTICAL PUMPING
Improved orientation characteristics of quantum magnetometer with joint operation of radio frequency field and modulated optical pumping
N72-25436
Physical design principles of optically pumped magnetometers based on orientation of atomic moments by polarized light, for measuring very weak magnetic fields
N72-25438
Xenon flashlamp driver system for optical laser pumping
[NASA-CASE-ERC-10283] N72-25485

OPTICAL RADAR
Optical radar technique using laser energy for studying atmosphere
N72-25357
Potential of laser radar as ground based remote sensor of atmosphere
[CONTRIB-62] N72-25358
Optical radar observations above 30 km
N72-25359
Optical radar measurements of atmospheric aerosols
N72-25360
Using lidar to determine size and concentration of atmospheric aerosols
N72-25361
Meteorological value of ultrasensitive radar
N72-25363

OPTIMAL CONTROL
Computerized optimal control for synthesis of load relief control system of Saturn 5 derivative launch vehicle
[NASA-CR-123646] N72-25465
Optimal control and functional differential equations with terminal conditons in function space
[NASA-CR-126769] N72-25558
Optimization technique, problem formulation, and results obtained in design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123644] N72-25843
Mathematical models used in application of modern optimal control techniques to design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123645] N72-25844

OPTIMIZATION
Computer programming and optimization of function subject to constraint
[AAR-99] N72-25225
Variable rate updating rules and solution of sequence of unconstrained minimization problems
[AAR-90] N72-25229
Numerical analysis for optimal dimensions of semiconductors in cryogenic systems
[DISS-4656] N72-25690
Optimum shape and size for edge stiffeners for thin walled compression elements
[TN-7] N72-25893
Optimal design of plates and shells for global behavioral constraints
[REPT-109] N72-25894

ORBIT CALCULATION
Conference on technological developments in satellite communications, tracking, antenna arrays, attitude control, orbit calculations, and instrumentation
[NASA-SP-295] N72-25755
Numerical integration and analytical models for computing Vanguard 2 orbit
N72-25757
Eccentricity perturbation prediction for lunar orbit of Radio Astronomy Explorer satellite
N72-25758
Photographic tracking and orbit calculation of cosmos 268 to determine upper atmosphere zonal wind speeds
[RAE-TR-71202] N72-25838
Geodetic satellite tracking and orbit computations for ISAGEX operations
[NASA-TM-X-65886] N72-25860

ORBIT PERTURBATION
Transformation of motion equations in disturbed Kepler boundary problem of celestial mechanics
[DISS-4676] N72-25570
Explicit theory of orbit perturbations due to zonal gravitational harmonics
N72-25738

ORBITAL MECHANICS
Transformation of motion equations in disturbed Kepler boundary problem of celestial mechanics
[DISS-4676] N72-25570
Numerical algorithm for determining optimal plane changes of three impulse transfers between noncoplanar circular orbits
[NASA-TM-X-64662] N72-25809

Revised specifications of baseline set of equations necessary to perform guidance, navigation, and control functions during orbital operations of space shuttle orbiter
[NASA-TM-X-68368] N72-25873
ORGANIC COMPOUNDS
Development of process for preparing N,N-dialkyltrifluoroacetamides and interpretation of process using gas chromatography
[NASA-TN-D-6836] N72-25161
ORGANIC MATERIALS
Organic materials for underwater protection of timber attacked by shipworms
[REPT-498] N72-25549
ORGANS
Anatomical function of spermaceti organ in sperm whales
[CONTRIB-74] N72-25087
ORIENTATION
Orientation of nocturnally migrating birds based on reference to stellar positions and sky rotation
N72-25074
Analysis of cues used by migratory birds for navigation and orientation
N72-25076
Analysis of effects of topography on homing ability of pigeons as determined by ground release and helicopter tracking
N72-25077
Effects of clock shift on orientation of migratory birds and deviations in initial orientation produced by varying amounts of clock shift
N72-25078
Analysis of cues used by homing pigeons with emphasis on effects of sun location and magnetic fields
N72-25079
Function of visual cues in orientation navigation systems of desert ants
N72-25088
Effect of chemical stimuli on orientation behavior of fish
N72-25090
Physiological and biological mechanisms responsible for anemomenotactic orientation in beetles and scorpions
N72-25093
Directional orientation of dragonfly relative to azimuth of sun
N72-25094
Nocturnal orientation by amphipods using moonlight
N72-25095
Magnetoreception and orientation in dancing bees
N72-25096
ORIFICE FLOW
Orifice efficiencies for air flow into compartment from flowing external stream
[NASA-CR-61383] N72-25305
ORIGINS
Theory on origin of solar system
N72-25751
ORION CONSTELLATION
Formaldehyde emission and H2CO absorption in Orion nebula
[NASA-TM-X-65897] N72-25342
ORTHOGONAL FUNCTIONS
Orthogonal collineation for formulating metric planes by transformation axioms
N72-25564
OSCILLATIONS
Development of electric circuit for suppressing parasitic oscillations across inductor operating in resonant mode
[NASA-CASE-ERC-10403-1] N72-25280
Device for suppressing pressure oscillations in fluid transmission line
[NASA-CASE-MFS-10354-2] N72-25306
Forced response of laminar boundary layers to free stream oscillations in oscillating flow wind tunnel
[AD-737856] N72-25318
Analysis of leading edge flow separation resulting from airfoils oscillating in uniform flow field at low Reynolds numbers
[AD-738304] N72-25320
Nonlinear oscillations in automatic control systems
[AD-738124] N72-25574
OSCILLATORS
Inverter oscillator with voltage feedback
[NASA-CASE-NPO-10760] N72-25254
OSMOSIS
Metallic osmotic membranes for desalinization of sea water
[CEA-R-4129] N72-25533
OUTPUT
Automata functioning in stationary random media with restricted length of input word and minimization of losses
N72-25138
Methods and digital computer system for automated speech output
N72-25139
OXIDATION RESISTANCE
Thermomechanical and thermochemical behavior of high temperature, oxidation resistant, hafnium-20 percent tantalum alloy
[NASA-TM-X-68339] N72-25524
Evaluation of refractory materials for furnace cores operating under oxidizing conditions
[NASA-CR-122425] N72-25551
OXYGEN MASKS
Physiological evaluation of disposable jet transport passenger oxygen mask at high altitude
[FAA-AM-72-10] N72-25131
OXYGEN SUPPLY EQUIPMENT
Solid electrolyte oxygen regeneration system with electrolyzer, carbon deposition reactor, and palladium membranes for separating hydrogen
[NASA-CR-2014] N72-25125
Design, development, and installation of high pressure oxygen impact tester
[NASA-CR-123643] N72-25418

P

PANEL FLUTTER
Effects of random excitation on cavity pressure and panel vibrations
[NASA-CR-112051] N72-25623
PANELS
Honeycomb panels of minimal surface, periodic tubule layers
[NASA-CASE-ERC-10364] N72-25540
Effects of eccentricities and lateral pressure on design of stiffened compression panels
[NASA-TN-D-6784] N72-25904
PARACHUTES
Failure of parachute on Apollo 15 spacecraft during earth landing
[NASA-TM-X-68350] N72-25848
PARAMETERIZATION
Analysis method for random parametric effects in spacecraft control systems
N72-25869
PARAMETRIC AMPLIFIERS
Development of idler feedback system to reduce electronic noise problem in two parametric amplifiers
[NASA-CASE-LAR-10253-1] N72-25258
PARTICLE DIFFUSION
Particle pitch angle distribution and weak diffusion in plasma layer during magnetic substorm
[NASA-TT-F-14190] N72-25330
PARTICLE ENERGY
Calculation of finite, nonspherical nuclear systems using BHF method to determine intrinsic spectra, radii, quadrupole moments, and hexadecapole moments
[NASA-TN-D-6834] N72-25646
PARTICLE INTERACTIONS
Mode coupling and wave particle interactions for unstable ion acoustic waves
[NASA-CR-122421] N72-25640
Initial and final state mechanisms of sequential three-body reactions and angular distribution of disintegration products
[DISS-4684] N72-25651
Sigma value in pion-nucleon scattering and other low energy parameters
[ISS-71/20] N72-25652
PARTICLE PRODUCTION
Gage invariance and on-shell extrapolation of pion electroproduction at threshold
[NOTA-INTERNA-354] N72-25663
Geometrical model for epsilon production noting pion exchange
[NOTA-INTERNA-357] N72-25664
PARTICLE SIZE DISTRIBUTION
Method of measuring mist droplets by size and number
[RAE-LIB-TRANS-1627] N72-25302
Using lidar to determine size and concentration of atmospheric aerosols
N72-25361
PARTICLES
Computerized simulation for construction and calculation of properties of particulate solids in two and three dimensional systems
[BM-BULL-658] N72-25228
Velocity of particulate matter in laminar and turbulent gas flow, and holographic techniques
[PB-206950] N72-25510
PASSIVITY
Anodic and cathodic passivation of aluminum electrode in AlCl3-KCl-NaCl melts between 100 and 160 C
[NASA-CR-126727] N72-25153
PATTERN RECOGNITION
Analysis of pattern recognition capability of migratory birds and manner of orientation with stellar presentations
N72-25075
Multivariate approaches to pattern recognition and dyspepsia cures
[AD-737268] N72-25117
PENDULUMS
Development of torsional pendulum apparatus for determining effects of vacuum on mechanical properties of two ablator materials
[NASA-CR-2074] N72-25548
PENNING DISCHARGE
Electric potential distribution along ion beam with application to Penning discharge
[TRITA-EPP-71-26] N72-25674
PERCEPTION
Measuring method for cutaneous perception using instrument with elongated tubular housing
[NASA-CASE-MSC-13609-1] N72-25122
PERFLUORO COMPOUNDS
Silphenylenesiloxane polymer with in-chain perfluoroalkyl groups
[NASA-CASE-MFS-20979] N72-25151
Polymerization of perfluorobutadiene
[NASA-CASE-NPO-10863-2] N72-25152
PERFORMANCE
Digital processors for improving optimum performance of MTI
[AD-738298] N72-25201
Design and performance analyses of SNAP 199 fuel element core
[AI-AEC-13017] N72-25618
PERFORMANCE PREDICTION
Computer program for predicting performance, noise, weight, and cost of general aviation aircraft propellers for 1980 time period
[NASA-CR-2066] N72-25005
PERFORMANCE TESTS
Performance tests of lunar mass spectrometer designed to sample and measure gases in lunar atmosphere at surface
[NASA-CR-126772] N72-25429
Performance tests and evaluation of gas generating and charging equipment for handling gaseous and cryogenic materials
[AD-738120] N72-25484
Development of experiments for testing inertial instruments in drag-free satellite
[AD-738309] N72-25608
Design and experimental performance of rotating fluidized bed reactor for use in nuclear propulsion systems
[NASA-CR-126738] N72-25611
Quality control tests on high velocity aircraft rockets and their ignition characteristics
[TL-1971-7] N72-25849
Design, development, and performance of lunar module landing gear subsystem
[NASA-TN-D-6850] N72-25903
PERIODIC VARIATIONS
Effects of atmospheric pressure, density, temperature, and wind variations on spacecraft stability, control, and heating
[NASA-CR-2062] N72-25336
PERSPIRATION
Manufacturing process for making prespiration resistant-stress resistant biopotential electrode
[NASA-CASE-MSC-90153-2] N72-25120
PERTURBATION THEORY
Method to derive statistical characterizations of perturbations imposed upon wave propagating through random medium such as earth atmosphere
N72-25349
Methods for analysis of random effects in spacecraft control systems and for evaluating system precision
[JPRS-56134] N72-25868
Methods for evaluating precision of spacecraft control systems operating under influence of large number of perturbations
N72-25870
PHASE LOCKED SYSTEMS
Minimax solution of second order phase lock loop acquisition by computerized simulation
N72-25555
Carrier tracking loop for phase lock micrometer laser receiver
N72-25771
PHASE SHIFT
Pulse code modulated data from frequency multiplex communications by digital phase shift or carrier
[NASA-CASE-NPO-11338] N72-25208
PHASED ARRAYS
Techniques for control of phased array antenna used in ground terminal of satellite communication system
[AD-738303] N72-25202
PHILIPS IONIZATION GAGES
Adaptation of Philips pulsed heavy gage ion source to bevatron
[LBL-304] N72-25613
PHONOCARDIOGRAPHY
Signal and data processing technology for diagnostic techniques in phonocardiography
N72-25801
PHONONS
Energy-momentum relation for weakly coupled optical polarons and phonon cross exchange
N72-25653

Effect of hydrostatic pressure on phonon spectrum of Pb-In alloys using electron tunneling N72-25654

PHOTODISSOCIATION
Organic structure of aromatic compounds after photoionic and photosensitive dissociation N72-25156

PHOTOGRAPHIC MEASUREMENT
Construction and operation of high speed rotary camera for photographing moving self-luminous objects
[RAE-LIB-TRANS-1621] N72-25441

PHOTOGRAPHIC RECORDING
Construction and operation of high speed rotary camera for photographing moving self-luminous objects
[RAE-LIB-TRANS-1621] N72-25441
Mathematical models and numerical analysis of coherent optical systems used as holographic schlieren system N72-25496
Principles for producing holograms and methods of recording interference pattern between reference beam and reflected light waves N72-25499

PHOTOGRAPHIC TRACKING
Photographic tracking and orbit calculation of cosmos 268 to determine upper atmosphere zonal wind speeds
[RAE-TR-71202] N72-25838

PHOTOIONIZATION
Organic structure of aromatic compounds after photoionic and photosensitive dissociation N72-25156

PHOTOLYSIS
Analysis of nonradiative transitions in Xanthine coloring matter by flash photolysis and spectrofluorometry N72-25155

PHOTOMETERS
Piecewise cross correlation technique for analyzing outputs of remote detection devices to eliminate noise from optical background fluctuations N72-25381
Development of radiant energy sensor to detect the radiant energy wavelength bands from portions of radiating body
[NASA-CASE-ERC-10174] N72-25409

PHOTOMETRY
Characteristics of faint stars at high galactic latitudes determined by UBV photometry N72-25417

PHOTONS
Unfiltered photon data from laser ranging between McDonald Observatory and reflector at Tranquility Base
[NASA-CR-126747] N72-25486

PHOTONUCLEAR REACTIONS
Photonuclear reactions and nuclear cross sections
[AD-738005] N72-25666

PHOTOSENSITIVITY
Directional orientation of dragonfly relative to azimuth of sun N72-25094
Organic structure of aromatic compounds after photoionic and photosensitive dissociation N72-25156

PHOTOSPHERE
Basic physical properties involved in large-scale structure of solar interior and atmospheric layers N72-25811

PHYSICAL EXAMINATIONS
Aeromedical requirements and examination techniques for aircrews - conference
[AGARD-CP-95-PT-2] N72-25048
Medical elimination of students undergoing primary flight training N72-25049
Anthropometry and medical re-evaluation of pilots N72-25055

PHYSICAL FACTORS
Social, economic, and physical impact of high energy physics accelerator laboratory on environment
[WASH-1505] N72-25291

PHYSICAL FITNESS
Aeromedical requirements and examination techniques for aircrews - conference
[AGARD-CP-95-PT-2] N72-25048
Raised arterial blood pressure levels in aircrew members N72-25054

PHYSICAL PROPERTIES
Analysis of physical properties of materials to determine correlation with resistance to corrosion
[AD-738162] N72-25537
Physical characteristics, and system effectiveness of high power airborne military illuminating sources
[AD-737832] N72-25678
Analysis of thermophysical properties of thermal control coatings used on Apollo 9 flight
[NASA-TN-D-6863] N72-25864

PHYSICAL WORK
Diver performance in manual and mental tasks at 66 feet
[AD-737376] N72-25116

PHYSIOLOGICAL EFFECTS
Effects of high intensity noise levels on human vestibular system and production of disorientation and nausea
[AMRL-TR-71-58] N72-25038
Occurrences of vertigo in hyperbaric atmospheres and among underwater divers with theoretical explanations of etiology involved N72-25043
Development of theory concerning human reactions to whole body motion and explanation of individual differences to motion effects N72-25044
Effects of toxic methyl isobutyl ketone vapor on physiological processes in dogs, monkeys, and rats during 90 day continuous exposure
[NASA-CR-126744] N72-25102
Restraint torso for increased mobility and reduced physiological effects while wearing pressurized suits
[NASA-CASE-MSC-12397-1] N72-25119
Human factors engineering to determine effects of weapon noise on military personnel and development of criteria for performance prediction of personnel after exposure to noise
[AD-738135] N72-25145

PHYSIOLOGICAL FACTORS
Physiological evaluation of disposable jet transport passenger oxygen mask at high altitude
[FAA-AM-72-10] N72-25131

PHYSIOLOGICAL RESPONSES
Procedure for determining cases of mild intoxication based on postrotational fixation nystagmus N72-25039

PHYSIOLOGICAL TESTS
Procedure for determining cases of mild intoxication based on postrotational fixation nystagmus N72-25039
Physiological tests of vestibulo-ocular reflex by counterroll to determine effects of positive acceleration on dynamics of vestibular system of rhesus monkeys
[AMRL-TR-71-59] N72-25040
Design and operation of IMBLMS
[NASA-CR-115664] N72-25143

PHYSIOLOGY
Environmental and endogenous timing factors as stimuli for bird migration N72-25082

PIGEONS
Analysis of effects of topography on homing ability of pigeons as determined by ground release and helicopter tracking N72-25077
Analysis of cues used by homing pigeons with emphasis on effects of sun location and magnetic fields N72-25079
Light source position measuring mechanism of homing pigeons N72-25080
Magnets as navigation aids to homing pigeons N72-25098

PILOT ERROR
Aircraft accident report concerning DC-9 aircraft contact with ocean surface and subsequent emergency landing at Martha's Vineyard, Massachusetts, June 22, 1971
[PB-207101] N72-25013

PILOT PERFORMANCE
Contribution of reduced visibility and turbulence to loss of aircraft control and inadvertent aircraft maneuvers N72-25041
Analysis of aircraft pilot reports on occurrence of unreality and detachment during flight and relationship to spatial disorientation N72-25042
Mathematical models for describing pilot performance during multiple input-output controller tasks
[NASA-CR-112048] N72-25128
Pilot tracking performance during in-flight simulated instrument approaches with single engine general aviation aircraft
[FAA-AM-72-9] N72-25130

PILOT TRAINING
Pilot tracking performance during in-flight simulated instrument approaches with single engine general aviation aircraft
[FAA-AM-72-9] N72-25130

PILOTS
Long term ECG examinations of pilots using tests at rest and master tests N72-25050
Anthropometry and medical re-evaluation of pilots N72-25055
Radiological spinal examination of combat pilots and limiting angle for scoliosis N72-25056
Alcohol-induced postrotatory fixational nystagmus and detection of alcohol intoxication in pilots N72-25060
Factors contributing to attrition from active airman status, particularly biological and medical characteristics
[FAA-AM-72-13] N72-25104

PIONEER PROJECT
Conducting exploratory investigations beyond Mars orbit by Pioneer F/G program
[NASA-TM-X-68340] N72-25866

PIONEER 8 SPACE PROBE
Temporal variations, energy spectrum, and directional properties of solar cosmic rays studied with Pioneer 8 and 9 data N72-25716

PIONEER 9 SPACE PROBE
Temporal variations, energy spectrum, and directional properties of solar cosmic rays studied with Pioneer 8 and 9 data N72-25716

PIONS
Calculation of pion-Pomeranchon Regge cut from Mandelstam diagram for three pion exchange processes
[ILL-[TH]-72-5] N72-25642
Sigma value in pion-nucleon scattering and other low energy parameters
[ISS-71/20] N72-25652
Gage invariance and on-shell extrapolation of pion electroproduction at threshold
[NOTA-INTERNA-354] N72-25663
Geometrical model for epsilon production noting pion exchange
[NOTA-INTERNA-357] N72-25664
Elementary pion with transverse momentum cutoff and pion contribution to neutron spectra in high energy reactions
[NOTA-INTERNA-360] N72-25665

PIPE FLOW
Application of polymers for reduction of pipe flow drag in commercial water supplies and effect of temperature on polymer effectiveness
[AD-738255] N72-25319

PIPES [TUBES]
Measuring method for cutaneous perception using instrument with elongated tubular housing
[NASA-CASE-MSC-13609-1] N72-25122
Low mass truss structure with elongated thin-walled tubular segments
[NASA-CASE-LAR-10546-1] N72-25287
Procedure and apparatus for ultrasonic tests of welded Y joints and Inconel tubes
[TR-7108.533] N72-25458
Honeycomb panels of minimal surface, periodic tubule layers
[NASA-CASE-ERC-10364] N72-25540
Honeycomb core structures of minimum surface tubule sections
[NASA-CASE-ERC-10363] N72-25541

PISTON ENGINES
Analysis of emissions from aircraft piston and gas turbine engines - tables
[PB-207107] N72-25589

PITCH [INCLINATION]
Particle pitch angle distribution and weak diffusion in plasma layer during magnetic substorm
[NASA-TT-F-14190] N72-25330

PLANETARY ATMOSPHERES
Solar physics, planetary atmospheres, comets, and earth aurora and upper atmosphere, studied with satellite, rocket, and space probe data N72-25805
Solar system, solar physics, planetary atmospheres and structure, and origin of planets and moon - conference
[NASA-SP-300] N72-25810
Composition, thermal structure, density, and unusual characteristics of planetary lower atmospheres, emphasizing Mars, Venus, and Jupiter atmospheres N72-25816
Atmospheric compositions of planets, satellites, and comets N72-25817
Present and past compositions and evolution of Earth, Venus, Mars, and Jupiter atmospheres N72-25822
Line shape and band structure effects on radiative equilibrium temperature profile in planetary atmospheres and method for treating nongrey radiative transfer problems
[NASA-TM-X-6509] N72-25827

PLANETARY EVOLUTION
Solar system, solar physics, planetary atmospheres and structure, and origin of planets and moon - conference
[NASA-SP-300] N72-25810
Theories of solar system origin, emphasizing primitive nebula and accretion N72-25821
Present and past compositions and evolution of Earth, Venus, Mars, and Jupiter atmospheres N72-25822

PLANETOLOGY
Interior structure of Jupiter and other giant planets N72-25818
Passive radio, radar, and radio occultation exploration of planets N72-25819

PLANTS [BOTANY]
Plant cultivation in closed ecological system in space flight
[JPRS-56129] N72-25106
Bibliography on use of remote sensing in forestry, agriculture, and plant ecology
N72-25327

PLASMA CONDUCTIVITY
Effect of current and ion sound instability on plasma electrical conductivity in strong electric fields
[LA-TR-71-79] N72-25673

PLASMA DIAGNOSTICS
Electron energy plasma ion density, and electric potential in simulated thermionic energy converter
[NASA-CR-126866] N72-25668
Plasma diagnostics, using monoenergetic potassium beam for transparency measurements
[EUR-CEA-FC-615] N72-25669
Bremsstrahlung X rays, optical diagnostics, and microwave calculations
[COO-1695-39] N72-25671
Development and characteristics of electronic diagnostic system for analysis of plasma medium
[AD-738306] N72-25677
Interplanetary plasma diagnostics and solar wind observations during normal and disturbed times
N72-25815

PLASMA DIFFUSION
Mathematical models for calculating drift paths of low energy plasma flow in magnetosphere
N72-25325

PLASMA DYNAMICS
Development and characteristics of electronic diagnostic system for analysis of plasma medium
[AD-738306] N72-25677

PLASMA INTERACTIONS
Plasma collisions producing multiply charged heavy ions
[EUR-CEA-FC-624] N72-25670

PLASMA LAYERS
Particle pitch angle distribution and weak diffusion in plasma layer during magnetic substorm
[NASA-TT-F-14190] N72-25330
Ionospheric double layers in topside and F region, stability, and anomalous resistivity
[TRITA-EPP-72-07] N72-25395

PLASMA PHYSICS
Mode coupling and wave particle interactions for unstable ion acoustic waves
[NASA-CR-122421] N72-25640
Numerical analysis of radiant heat flux and local energy loss of line in region of strong variations of source function in one direction
[NASA-CR-126965] N72-25925

PLASMA RADIATION
Computer simulation of plasmas, using particle models
[TID-25912] N72-25672

PLASTIC DEFORMATION
Deformation and fracture of fine-grained alpha-beta brass
[REPT-92] N72-25515
Elastic-plastic deformation analysis of plane frames using linear programming
[REPT-88] N72-25896

PLASTIC PROPERTIES
Microstructure of superplastic micrograin aluminum bronze
[REPT-93] N72-25514
Influence of cracks on tensile strength of steel test bar and on strength and plasticity of aluminum alloys
N72-25530

PLATE THEORY
Finite difference schemes for solving linear dynamic plate and shell equations
N72-25878

PLATES [STRUCTURAL MEMBERS]
Measurement of sound attenuation after impact of steel balls on plates
[REPT-7107.521] N72-25625
Series solutions for free vibration of edge stiffened square plate
N72-25879
Optimal design of plates and shells for global behavioral constraints
[REPT-109] N72-25894

PLOTTERS
High speed microfilm plotter for data recording, emphasing software packages
N72-25235

PLUTONIUM OXIDES
Thermal compatibility of production grade [Pu-238]O2 and nickel and cobalt base alloys
[MLM-1864] N72-25535

PNEUMATIC EQUIPMENT
Performance tests and evaluation of gas generating and charging equipment for handling gaseous and cryogenic materials
[AD-738120] N72-25484

POGO EFFECTS
Test facility for analyzing pogo phenomenon in liquid fuel launch vehicles
N72-25841

POISONS
Marine biocidal properties of elastomer compounds and sea water exposure tests
[REPT-496] N72-25550

POISSON EQUATION
Construction of matrices for Poisson equation using method of integral relations
N72-25573

POLAR REGIONS
HF backscatter system for collecting auroral clutter data
[AD-738305] N72-25203
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Apr. - June 1971
N72-25390
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Jul. - Sep. 1971
N72-25391
Polar upper atmosphere data recorded at Kiruna Geophysical Observatory, Sweden, from Oct. - Dec. 1971
N72-25394
Access of interplanetary protons and electrons to polar cap regions and geomagnetic tail configurations
[NASA-CR-122359] N72-25726

POLARITY
Critical shear stress of alkali halides containing non-agglomerated and agglomerated elastic dipoles
[NRC-TT-1544] N72-25166

POLARIZED LIGHT
Self-oscillating magnetometer using linearly polarized light modified with Larmor precession frequency
N72-25432
Physical design principles of optically pumped magnetometers based on orientation of atomic moments by polarized light, for measuring very weak magnetic fields
N72-25438
Multiple scattering of polarized light using doubling method
[NASA-CR-126753] N72-25624

POLAROGRAPHY
Polarography of heterocyclic methaqualone, Dormutil, and ethinazone
[RAE-LIB-TRANS-1608] N72-25165

POLARONS
Energy-momentum relation for weakly coupled optical polarons and phonon cross exchange
N72-25653

POLICIES
FAA national policies on overall missions and criteria for major subsystems
[REPT-1000.27-APP-1] N72-25949
National aviation system plan 1973-1982, as joint industry-government program
[REPT-1000.27-APP-2] N72-25950

POLYESTERS
Tensile and shear strength of polyester yarns for balloon materials
[NASA-CR-2047] N72-25546

POLYMERIC FILMS
Polymeric film-metal-film sandwich laminate for reduced permeability material of cryogenic expulsion bladder
[NASA-CR-120892] N72-25159

POLYMERIZATION
Silphenylenesiloxane polymer with in-chain perfluoroalkyl groups
[NASA-CASE-MFS-20979] N72-25151
Polymerization of perfluorobutadiene
[NASA-CASE-NPO-10863-2] N72-25152

POLYMERS
Mercaptan terminated polymer containing sulfonic acid salts of nitrosubstituted aromatic amines for heat and moisture resistant coatings
[NASA-CASE-ARC-10325] N72-25147
Application of polymers for reduction of pipe flow drag in commercial water supplies and effect of temperature on polymer effectiveness
[AD-738255] N72-25319

POLYMORPHISM
Crystal structure of olivine and polymorphism
[NASA-TT-F-14243] N72-25687

POLYNOMIALS
Invariant coefficients of characteristic polynomial for n X n matrix
[NASA-TM-X-65885] N72-25562
Development of convergent iteration procedure for determining roots of polynomials and computer program for machine calculation of complex series
[DISS-4653] N72-25566

PORTABLE EQUIPMENT
Portable tester for monitoring bacterial contamination by adenosine triphosphate light reaction
[NASA-CASE-GSC-10879-1] N72-25413

POSITION [LOCATION]
Light source position measuring mechanism of homing pigeons
N72-25080
Effects of specialized auditory stimuli on human performance of spatial orientation tasks
[AD-737351] N72-25112

POSITIONING DEVICES [MACHINERY]
Linear displacement actuator including switching circuit and laser interferometer gage
N72-25804

POSTFLIGHT ANALYSIS
Postflight analysis of EVCS to LM communications link for Apollo 15 mission to verify performance prediction techniques
[NASA-TM-X-68426] N72-25183
Apollo mission planning for lunar module descent and ascent based on postflight analysis of previous missions
[NASA-TN-D-6846] N72-25855

POTASSIUM
Plasma diagnostics, using monoenergetic potassium beam for transparency measurements
[EUR-CEA-FC-615] N72-25669

POTASSIUM CHLORIDES
Anodic and cathodic passivation of aluminum electrode in AlCl3-KCl-NaCl melts between 100 and 160 C
[NASA-CR-126727] N72-25153

POTENTIAL FLOW
Potential flow due to superposition of parallel and vortex flows
[REPT-94] N72-25300

POWDER [PARTICLES]
Analysis of powder residue following one dimensional combustion and dependence on initial temperature and pressure
N72-25926

POWDER METALLURGY
Dry electrode manufacture, using silver powder with cement
[NASA-CASE-FRC-10029-2] N72-25121
Grinding mixtures of powdered metals and inert fillers for conversion to halide
[NASA-CASE-LEW-10450-1] N72-25448
Small displacement, strain, finite element technique, using constant strain triangle for gravity flow of powder
[BM-RI-7577] N72-25473

POWER AMPLIFIERS
Circuitry and electrical performance of solid state Ku band IMPATT diode amplifier
[NASA-CR-122426] N72-25270

POWER EFFICIENCY
Thermal vacuum tests of TBC-1 power performance at 715 and 935 C hot shoe temperatures
[TID-25901] N72-25616

POWER SUPPLY CIRCUITS
Dc to ac to dc converter with transistor driven synchronous rectifiers
[NASA-CASE-GSC-11126-1] N72-25253
Low pass filter requirements and performance in variable speed constant frequency system for aircraft electric power supplies
[RAE-TR-71088] N72-25273

PRECIPITATION HARDENING
Effect of age hardening on stress-strain curves
[RAE-LIB-TRANS-1525] N72-25525

PREDICTION ANALYSIS TECHNIQUES
Methods for predicting B-12 values for binary gas mixtures containing alkanes
[NPL-DCS-14] N72-25167
Prediction method for subsonic flow of inviscid fluid through duct of arbitrary cross section
N72-25294
Method for computing noise generated by standing and flying jet aircraft
[ONERA-NT-187] N72-25636
Safety effectiveness analysis for large complex system
N72-25985

PREDICTIONS
Statistical modeling for predicting events and trends of complex systems
N72-25136

PREPARATION
General principles and detailed procedures on lapping, gluing, and polishing of ultrathin samples of lunar rocks and particulates - manuals
[NASA-CR-115554] N72-25744

PRESSURE DISTRIBUTION
Device for suppressing pressure oscillations in fluid transmission line
[NASA-CASE-MFS-10354-2] N72-25306

PRESSURE EFFECTS
Collisional energy transfer during vibrational excitation of HF and DF at high temperature and pressure
[AD-738296] N72-25168
Effects of eccentricities and lateral pressure on design of stiffened compression panels
[NASA-TN-D-6784] N72-25904

PRESSURE MEASUREMENTS
Device for regulating and monitoring pneumatic pressure in underwater space suit
[NASA-CASE-MFS-20332-2] N72-25124

PRESSURE REGULATORS
Device for regulating and monitoring pneumatic pressure in underwater space suit
[NASA-CASE-MFS-20332-2] N72-25124

PRESSURE SENSORS
Development of laser testing technique for determining zero shift and change in sensitivity of pressure transducer
[NBS-TN-723] N72-25487
PRESSURE SUITS
Restraint torso for increased mobility and reduced physiological effects while wearing pressurized suits
[NASA-CASE-MSC-12397-1] N72-25119
Device for regulating and monitoring pneumatic pressure in underwater space suit
[NASA-CASE-MFS-20332-2] N72-25124
PRESSURE VESSELS
Pressure vessel analysis of shape, dimensions, and loads
[WTHD-35] N72-25901
PRINTED CIRCUITS
Computerized design of printed circuits using graphical display device in conversational mode
[FP/LP-DRS-1.501/71] N72-25243
Proceedings of conference on electrodeposited materials to describe properties and applications
[AD-738272] N72-25536
PROBABILITY THEORY
Analytical models for analyzing probable terrestrial microbial release from unmanned Mars landing spacecraft
[NASA-CR-126846] N72-25105
Probabilistic method for random regular tournaments
[P-4479] N72-25560
PROBLEM SOLVING
Effects of alcohol on problem solving tasks and vestibular stimulation
[FAA-AM-72-11] N72-25108
Variable rate updating rules and solution of sequence of unconstrained minimization problems
[AAR-90] N72-25229
Development of convergent iteration procedure for determining roots of polynomials and computer program for machine calculation of complex series
[DISS-4653] N72-25566
Finite difference schemes for solving linear dynamic plate and shell equations
N72-25878
PRODUCTION ENGINEERING
Worst case failure analysis on explosive package for lunar seismology experiment
N72-25980
Safety analysis aspects in production engineering for transportation systems
N72-25988
PRODUCTION MANAGEMENT
Data acquisition and processing systems for ESRO satellites, noting production control
N72-25241
Systems analysis for consumer product safety standards
N72-25982
PROGRAMMING LANGUAGES
Installation and use of MARK 3 compiler for advanced targeting study
[AD-735619] N72-25246
PROJECT MANAGEMENT
Applicability of NASA contract quality management and failure mode effect analysis procedures to USGS Outer Continental Shelf oil and gas lease management program
[NASA-TM-X-2567] N72-25955
PROPAGATION VELOCITY
Mathematical models for determining teleseismic travel time
[AD-737405] N72-25404
PROPELLERS
Computer program for predicting performance, noise, weight, and cost of general aviation aircraft propellers for 1980 time period
[NASA-CR-2066] N72-25005
PROPORTIONAL COUNTERS
Electronic systems of multiwire proportional counter to measure extra-solar X ray fluxes during Black Brant 4 flight
[NASA-CR-115509] N72-25743
PROPULSION SYSTEM CONFIGURATIONS
Analysis of requirements for thermionic reactor electric propulsion system
[NASA-CR-126867] N72-25704
Advanced techniques for determining long term performance of spacecraft liquid propulsion system components
[NASA-CR-126720] N72-25845
PROPULSION SYSTEM PERFORMANCE
Lunar module 5 reaction control system performance during descent and ascent
[NASA-TM-X-68342] N72-25846
PROTECTIVE COATINGS
Method for processing and plating helical coil with nickel cobalt
[NASA-CR-122418] N72-25478
Organic materials for underwater protection of timber attacked by shipworms
[REPT-498] N72-25549
PROTON ENERGY
Solar wind model having electrons and protons at same temperature near sun and proton thermal anisotropy beyond 0.4 AU
N72-25720
PROTON FLUX DENSITY
Proton events observed with OGO-D and some observed flux profiles
[NASA-CR-122360] N72-25727
PROTONS
Effect of corrected thermal conductivity expression on temperature distribution in protonosphere
[NASA-TM-X-65900] N72-25339
Access of interplanetary protons and electrons to polar cap regions and geomagnetic tail configurations
[NASA-CR-122359] N72-25726
Proton events observed with OGO-D and some observed flux profiles
[NASA-CR-122360] N72-25727
PROXIMITY
Proximity effects for superconducting and normal metals
[NASA-CR-126771] N72-25682
PSYCHOACOUSTICS
Effects of high intensity noise levels on human vestibular system and production of disorientation and nausea
[AMRL-TR-71-58] N72-25038
Human factors engineering to determine effects of weapon noise on military personnel and development of criteria for performance prediction of personnel after exposure to noise
[AD-738135] N72-25145
PSYCHOLOGY
Sensory and motor psychology studies with trained animals
N72-25081
PSYCHOPHYSIOLOGY
Occurrences of vertigo in hyperbaric atmospheres and among underwater divers with theoretical explanations of etiology involved
N72-25043
Multivariate approaches to pattern recognition and dyspepsia cures
[AD-737268] N72-25117
PULMONARY FUNCTIONS
Respiratory gas analyzer for aircrew pulmonary function measurements
[NASA-TM-X-68370] N72-25057
PULSARS
Interstellar absorption of Crab nebula soft X ray flux and X ray spectrum of Crab pulsar
N72-25734
PULSE CODE MODULATION
Analysis of allowable error rate in pulse code modulation system used with color television signal transmission
[BBC-1972/14] N72-25175
Pulse code modulated data from frequency multiplex communications by digital phase shift or carrier
[NASA-CASE-NPO-11338] N72-25208
PULSE COMMUNICATION
Development of computer program to describe uplink and downlink digital systems for manned spacecraft orbital missions - Vol. 2
[NASA-CR-115663] N72-25604
PULSE DURATION MODULATION
Load current sensor for series pulse width modulated power supply
[NASA-CASE-GSC-10656-1] N72-25249
PULSE GENERATORS
High frequency arc discharges and pulse generation for ultrasonic tests
[NASA-CASE-MFS-21233-1] N72-25627
PULSE HEATING
Deflection of electric arc by asymmetrical heating using high frequency pulsed radiation
[ISL-29/71] N72-25282
PULSED RADIATION
Focusing finite-amplitude cylindrical and spherical sound waves in viscous and heat conducting medium
[NASA-CR-112095] N72-25631
PURGING
Purge system and components of HRE AIM
[NASA-CR-112060] N72-25715
PURIFICATION
Theory and operation of electrostatic precipitator plates for gas purification
[DISS-4608] N72-25279

Q

Q FACTORS
Microwave circuit for measuring complex dielectric constant of polar liquid by cavity perturbation method
[NOTA-INTERNA-352] N72-25637
Q SWITCHED LASERS
Detonation of secondary high explosives by Q switched ruby laser
[NASA-CR-126741] N72-25492
Development and characteristics of holography cameras for use with Q switched ruby lasers
[NASA-CR-126767] N72-25501
QUADRUPOLES
Residual field theory for superconducting dipoles and quadrupole magnets
[KFK-EXT-3/71-10] N72-25695
QUALITATIVE ANALYSIS
Ultraviolet chromatographic detector for quantitative and qualitative analysis of compounds
[NASA-CASE-HQN-10756-1] N72-25428
QUALITY CONTROL
Design development and acceptance checkout testing programs for Apollo spacecraft
[NASA-TN-D-6857] N72-25475
Quality control tests on high velocity aircraft rockets and their ignition characteristics
[TL-1971-7] N72-25849
QUANTITATIVE ANALYSIS
Ultraviolet chromatographic detector for quantitative and qualitative analysis of compounds
[NASA-CASE-HQN-10756-1] N72-25428
QUANTUM STATISTICS
Green function method and quasi-electrons in quantum mechanical multiple particle models
[DISS-4705] N72-25163
Approximation method for quantum correction to kinetic energy function of decaying electron gas density and potential distribution
N72-25650
QUASARS
Jeans criterion and formation of stars within nucleus of quasar
[FRNC-TH-138] N72-25657
Gas cloud collisions as radiation sources for quasi-stellar objects
[NASA-CR-126723] N72-25742

R

RADAR ASTRONOMY
Passive radio, radar, and radio occultation exploration of planets
N72-25819
RADAR ECHOES
Accuracy and resolution in determining angular target coordinates by radar stations
N72-25196
Scattering mechanism of radar echoes from clear air
N72-25362
Meteorological value of ultrasensitive radar
N72-25363
Comments on high power, high resolution radars
N72-25366
RADAR EQUIPMENT
Performance tests of acoustic radar equipment to detect vortices formed by low flying aircraft and comparison with conventional sensing methods
[FAA-RD-71-103] N72-25008
Application of tracking radar for determining flight paths of migratory birds
N72-25069
Measurement of radar signal parameters and statistical approaches for selection of moving targets with interperiod compensation
[JPRS-56143] N72-25185
Characteristics of multichannel radar system and specific application for solution of radar tracking problems
N72-25197
Human factors engineering applied to development of radar symbology and discrimination in mixed displays for cathode ray tube presentation
[AD-738132] N72-25204
RADAR IMAGERY
Radar observations of migratory birds to determine effects of weather conditions on migration behavior
N72-25072
Measurement of radar signal parameters and statistical approaches for selection of moving targets with interperiod compensation
[JPRS-56143] N72-25185
Characteristics of multichannel radar system and specific application for solution of radar tracking problems
N72-25197
RADAR MEASUREMENT
Measurement of radar signal parameters and statistical approaches for selection of moving targets with interperiod compensation
[JPRS-56143] N72-25185
RADAR TARGETS
Digital processors for improving optimum performance of MTI
[AD-738298] N72-25201
RADAR TRACKING
Application of tracking radar for determining flight paths of migratory birds
N72-25069
Radar and visual tracking of migratory birds to determine correlation of flight altitude and wind direction on direction of migration
N72-25070
Radar observations of passerine birds to determine effects of wind and meteorological parameters on migratory behavior
N72-25071

Radar observations of migratory birds to determine effects of weather conditions on migration behavior N72-25072

Radar observations of birds migrating in opaque cloud cover to determine effects of wind and meteorological conditions N72-25073

Accuracy and resolution in determining angular target coordinates by radar stations N72-25196

Geodetic satellite tracking and orbit computations for ISAGEX operations [NASA-TM-X-65886] N72-25860

RADIATION

Development of radiant energy sensor to detect the radiant energy wavelength bands from portions of radiating body [NASA-CASE-ERC-10174] N72-25409

RADIATION DAMAGE

Radiation damage in natural zircon caused by alpha particle recoil of parent uranium nucleus [ORO-4049-2] N72-25659

Damage to thermal aluminum coating caused by short wavelength ultraviolet radiation N72-25769

Radiation and chemical effects on totally depleted silicon diodes as nuclear particle detectors N72-25786

RADIATION DISTRIBUTION

Components of initial nuclear radiation field from intermediate yield thermonuclear weapon [ORNL-TM-3396] N72-25660

Radiation field inside spacecraft using radioisotope thermoelectric generator N72-25770

RADIATION DOSAGE

Aerospace environment requirements for spacecraft operations, including information on solar activity, geomagnetic field, radiation dosage, and star catalogs N72-25239

RADIATION MEASURING INSTRUMENTS

Development and characteristics of gamma ray spectrometer for measurement of intense radiation using Compton scattering effect [NASA-CASE-MFS-21441-1] N72-25427

RADIATION SHIELDING

Passage of ionizing radiation through inhomogeneities in radiation shielding [TT-70-50155] N72-25641

RADIATION SOURCES

Distribution of cosmic ray sources, map of sky, and model of galactic field N72-25717

Gas cloud collisions as radiation sources for quasistellar objects [NASA-CR-126723] N72-25742

RADIATIVE HEAT TRANSFER

Line shape and band structure effects on radiative equilibrium temperature profile in planetary atmospheres and method for treating nongrey radiative transfer problems [NASA-TM-X-6509] N72-25827

Radiative heat transfer effects behind reflected shock waves in air and nitrogen [NASA-CR-126726] N72-25917

Numerical analysis of radiant heat flux and local energy loss of line in region of strong variations of source function in one direction [NASA-CR-126965] N72-25925

RADIATIVE TRANSFER

Analysis of nonradiative transitions in Xanthine coloring matter by flash photolysis and spectrofluorometry N72-25155

Hydrodynamics and radiative transfer models for RR Lyrae stars N72-25732

RADIO ASTRONOMY

Measurement of scintillations of small diameter and large diameter radio sources in several stars N72-25740

Passive radio, radar, and radio occultation exploration of planets N72-25819

RADIO ASTRONOMY EXPLORER SATELLITE

Eccentricity perturbation prediction for lunar orbit of Radio Astronomy Explorer satellite N72-25758

Orbital stability of Radio Astronomy Explorer satellite having four antenna booms N72-25759

Computer program for simulating spinning mode of orbiting flexible spacecraft N72-25762

RADIO ATTENUATION MEASUREMENT PROJECT

ATS 5 millimeter wave propagation measurements for determining atmospheric attenuation of earth-space links N72-25778

Analysis of spacecraft motions and radio frequency blackout during atmospheric entry [NASA-TM-X-2562] N72-25865

RADIO BEACONS

Atmospheric absorption measurements for meteorological research using microwave transmissions from satellite beacons N72-25351

RADIO COMMUNICATION

Measurements of harmonic distortion of sinusoidally modulated carrier using envelope and asymmetric sideband detectors [BBC-1972/13] N72-25176

Development of large, furlable spacecraft antennas using conical main reflectors with two and four reflection configurations [NASA-CR-126966] N72-25193

Development and characteristics of simulation facility for analyzing communication systems [AD-738297] N72-25200

Performance tests of L band communication concepts for air traffic control equipment installed in Applications Technology Satellite-F [NASA-TM-X-65906] N72-25601

Mechanics, acoustics, ultrasonics, radio, and structural engineering research N72-25626

RADIO FREQUENCIES

Characteristics of plane wave and localized disturbances affecting ultralow frequency and extremely low frequency propagation in ionosphere N72-25178

RADIO FREQUENCY HEATING

Engineering problems of RF heating fusion reactors below 100 MHz [ORO-3778-5] N72-25615

RADIO METEORS

Velocity and mass flux, physical characteristics, and classification and relation to comets of radio and radar meteors - overview [NASA-CR-112639] N72-25808

RADIO RELAY SYSTEMS

Techniques for control of phased array antenna used in ground terminal of satellite communication system [AD-738303] N72-25202

RADIO SOURCES [ASTRONOMY]

Far infrared sources in galactic H II regions, and possible relation to thermal radio sources and interstellar dust N72-25737

RADIO STARS

Absolute antenna gain measurement using signal emitted from radio star N72-25793

RADIO TELEMETRY

Application of Doppler effect and artificial satellite coverage for tracking wild animals N72-25063

Development and application of instrumentation for tracking movements of sea turtles and polar bears N72-25064

Development and application of radio telemetry equipment for tracking migration of birds N72-25065

Electronic equipment and techniques for using satellite systems to track animals to determine migratory and navigation behavior N72-25068

Analytical and empirical procedures for pre-emphasis determination of S band constant bandwidth FM/FM station [NASA-TM-X-64648] N72-25182

RADIO TRANSMISSION

Fourier series for field structure of electromagnetic waveguide and mechanism in dissipative medium [AD-737849] N72-25199

Transhorizon radio propagation for determining upper atmospheric structure N72-25370

Lack of dependence of low frequency, sky wave field strength variations during nighttime on solar activity in Europe [BBC-1972/12] N72-25731

RADIOACTIVE ISOTOPES

Research on biological effects of radioisotope inhalation [LF-44] N72-25109

Chemical analysis of copper base alloys using X ray spectrographs and radioisotope X ray analyzer [BM-RI-7635] N72-25520

Table of gamma ray energies and intensities from radioactive isotopes produced by [n,gamma] reactions [IRI-133-71-06] N72-25661

Conducting exploratory investigations beyond Mars orbit by Pioneer F/G program [NASA-TM-X-68340] N72-25866

RADIOACTIVE MATERIALS

Production of high purity radioiodine by bombardment of cesium heat pipe [NASA-CASE-LEW-11390-1] N72-25645

RADIOACTIVE WASTES

Radioactive waste management and wholesomeness of irradiated foodstuffs [TID-25940] N72-25617

RADIOCHEMICAL SEPARATION

Nondestructive gamma-gamma coincidence counting, radiochemical, and substoichiometric separation methods for determination of noble metals in meteorites N72-25511

RADIOLOGY

Radiological spinal examination of combat pilots and limiting angle for scoliosis N72-25056

RADIOMETERS

Absorption spectra of ground based passive microwave radiometric probing of atmosphere N72-25371

Temperature and water vapor soundings from HF infrared radiometry with high vertical resolution N72-25374

Inversion algorithm for satellite radiometric observations N72-25376

Analyzing use of infrared radiometry for remote atmospheric probing N72-25378

Development of radiant energy sensor to detect the radiant energy wavelength bands from portions of radiating body [NASA-CASE-ERC-10174] N72-25409

RADIOSONDES

Handbook for coding radiosonde reports by U.S. weather stations N72-25587

RADOMES

Flight tests of EC-130E aircraft with X band radome installed [ENEA-71-45] N72-25007

RADON

One-dimensional model for vertical diffusion of radon in 1 to 20 km region [UILU-ENG-72-2501] N72-25337

RAIL TRANSPORTATION

Hazard prediction analysis for safety management in operation of rail transportation systems N72-25983

RAMAN SPECTRA

High resolution nonlinear spectroscopy applied to line profile of Raman resonance in hydrogen gas [NOTA-INTERNA-349] N72-25662

RANDOM ERRORS

Analysis of allowable error rate in pulse code modulation system used with color television signal transmission [BBC-1972/14] N72-25175

RANDOM NOISE

Digital servocontrol system for random noise excitation in reverberant acoustic chamber [NASA-CASE-NPO-11623-1] N72-25628

RANDOM PROCESSES

Methods for analysis of random effects in spacecraft control systems and for evaluating system precision [JPRS-56134] N72-25868

Analysis method for random parametric effects in spacecraft control systems N72-25869

RANGE AND RANGE RATE TRACKING

Ionospheric bias correction methods in radio tracking of spacecraft N72-25756

Range sum and range-rate sum techniques for tracking synchronous satellites N72-25760

RANGEFINDING

Apollo VHF ranging system development program [NASA-TN-D-6851] N72-25187

Binary coded sequential acquisition ranging system for distance measurements [NASA-CASE-NPO-11194] N72-25209

RARE GASES

Trapped solar wind rare gases and isotope ratios for Apollo 12 fines and Apollo 11 breccia N72-25833

REACTION KINETICS

Initial and final state mechanisms of sequential three-body reactions and angular distribution of disintegration products [DISS-4684] N72-25651

REACTOR CORES

Design and performance analyses of SNAP 199 fuel element core [AI-AEC-13017] N72-25618

REACTOR DESIGN

Design and experimental performance of rotating fluidized bed reactor for use in nuclear propulsion systems [NASA-CR-126738] N72-25611

Engineering problems of RF heating fusion reactors below 100 MHz [ORO-3778-5] N72-25615

Design and performance analyses of SNAP 199 fuel element core [AI-AEC-13017] N72-25618

REACTOR PHYSICS
Design and experimental performance of rotating fluidized bed reactor for use in nuclear propulsion systems
[NASA-CR-126738] N72-25611

REACTOR SAFETY
Safety procedures for operating nuclear reactors
[NP-19199] N72-25614
Fault tree analysis on safety of reactor electrical control system
N72-25981

REACTOR TECHNOLOGY
Alternative schemes for providing closed loop reactor control in thermionic reactor systems
[NASA-CR-126868] N72-25610

REAL TIME OPERATION
Design and performance of real time computerized control system for large antenna
[NASA-CR-122417] N72-25194
Real time auxiliary computing facility for carrying out mission support and simulation programs during Apollo project
[NASA-TN-D-6855] N72-25223
Real time data acquisition and processing using IBM computers
N72-25240

RECEIVERS
System inputs, transmitter, and receiver of DC/EC digital system tests
[NASA-CR-115606] N72-25231
Assembly drawings of receiver unit for data compression/error correction digital test system
[NASA-CR-115607] N72-25232
Carrier tracking loop for phase lock micrometer laser receiver
N72-25771
Man-portable laser beacon and receiver system for land survey
N72-25802

RECEPTORS [PHYSIOLOGY]
Magnetoreception and orientation in dancing bees
N72-25096

RECOGNITION
Olfactory stimuli and ultrasonic signal methods for individual recognition between mother and infant brown bats
N72-25085

RECORDING INSTRUMENTS
Electronic equipment and systems used to track wild animals in order to determine migratory and navigational behavior
N72-25067

RECOVERABLE LAUNCH VEHICLES
Overview of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123664] N72-25705
Summary of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123667] N72-25706
Planning documentation associated with feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123666] N72-25707
Final cost estimates for engine configurations and schedules selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123673] N72-25708
Design data book for engine system and subsystems selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123674] N72-25709

RECTANGULAR PANELS
Lightweight rigid rectangular solar panel design utilizing improved composite sandwich of Al-core and carbon fibers
[ESRO-CR[P]-79] N72-25909

RECTIFIERS
Dc to ac to dc converter with transistor driven synchronous rectifiers
[NASA-CASE-GSC-11126-1] N72-25253

REDUCED GRAVITY
Chemical lasers using low or zero gravity chemical reactions
[NASA-CASE-MSC-10986-2] N72-25489

REFLECTION
D region electron density profiles from differential phase partial reflection measurements
[NASA-CR-126725] N72-25329

REFLECTORS
Operational characteristics of dolphin hydrolocator system
N72-25107
Multipurpose microwave antenna, employing dish reflector with plural coaxial horn feeds
[NASA-CASE-NPO-11264] N72-25174
Spherical wave expansion method for synthesizing fields of feed for spherical reflector
N72-25177
Infrared tunable laser with wavelength-selective reflectors, lasable dye solutions, and nonlinear mixing crystal
[NASA-CASE-ARC-10463-1] N72-25268

REFRACTING TELESCOPES
Design optimizations of space astronomical telescopes with nested geometries
N72-25779

REFRACTIVITY
Feasibility of line-of-sight microwave propagation experiments in analyzing significant meteorological problems
N72-25348
Line-of-sight methodology used with microwave propagation in remote atmospheric probing
N72-25350
Remote sensing of optical effects arising from refractive index variations of clear atmosphere by ground-to-ground line-of-sight optical methods
N72-25352
Local isotropy and turbulent fluctuations of refractive index in surface layer of atmosphere
N72-25353
Optical measurements of magnitude of scintillation as function of range and refractive index structure coefficient in near earth environment
N72-25354

REFRACTORY MATERIALS
Evaluation of refractory materials for furnace cores operating under oxidizing conditions
[NASA-CR-122425] N72-25551

REFRIGERATING
Heat exchanger and decontamination system for multistage refrigeration unit
[NASA-CASE-NPO-10634] N72-25619

REGENERATION [ENGINEERING]
Development of regenerable or partially regenerable life support systems use in EVA protective systems
[NASA-CR-114382] N72-25133

REGGE POLES
Calculation of pion-Pomeranchon Regge cut from Mandelstam diagram for three pion exchange processes
[ILL-[TH]-72-5] N72-25642

REINFORCEMENT [STRUCTURES]
Effects of eccentricities and lateral pressure on design of stiffened compression panels
[NASA-TN-D-6784] N72-25904

RELATIVITY
Experiments for determining potential uses of future deep space missions in studies of relativistic gravity
[NASA-CR-126746] N72-25928

RELAXATION METHOD [MATHEMATICS]
Highly convergent relaxation method for temperature profile determination in atmosphere
N72-25375

RELIABILITY ANALYSIS
Reliability analysis on petroleum industry requirements
N72-25986

REMOTE SENSORS
Development and application of radio telemetry equipment for tracking migration of birds
N72-25065
Electronic equipment and systems used to track wild animals in order to determine migratory and navigational behavior
N72-25067
Measurement of currents associated with quiet auroral arc using vector magnetometer and lunar aspect sensor
N72-25324
Bibliography on use of remote sensing in forestry, agriculture, and plant ecology
N72-25327
Conference papers dealing with remote probe techniques for observing and measuring physical composition and dynamical structure of atmosphere
[NASA-CR-126787] N72-25347
Remote sensing of optical effects arising from refractive index variations of clear atmosphere by ground-to-ground line-of-sight optical methods
N72-25352
Incoherent and coherent CW laser systems for remote atmospheric probing
N72-25355
Remote probing of optical strength of atmospheric turbulence and of wind velocity at various altitudes by measuring spatial and temporal covariance of scintillation
N72-25356
Potential of laser radar as ground based remote sensor of atmosphere
[CONTRIB-62] N72-25358
Transhorizon propagation or tropospheric scatter as possible tools for remote sensing in atmosphere
N72-25367
Linear statistical inversion from ground based microwave probing
N72-25372
Meteorological parameter effects on passive remote sensing at microwave wavelength
N72-25373
Remote atmospheric probing approaches in infrared from satellites for Global Atmospheric Research Program
N72-25377
Analyzing use of infrared radiometry for remote atmospheric probing
N72-25378
Using airborne scanning infrared spectrometer for remote detection of CAT
N72-25379
Remote measurement of winds and atmospheric turbulence by cross-correlation of passive optical signals
N72-25380
Piecewise cross correlation technique for analyzing outputs of remote detection devices to eliminate noise from optical background fluctuations
N72-25381
Use of acoustic waves for remote probing of lower atmosphere
N72-25384
Vertical profiles of wind and temperature by remote acoustical sounding
N72-25386
Design and development of remote sensors for oceanographic experiments on marine biology and thermal pollution
[AD-737348] N72-25405

RESEARCH
Briefings on energy sources, resources, and research
N72-25929

RESEARCH AND DEVELOPMENT
Research by School of Engineering during 1971 at Purdue University
N72-25263
Developments in measurement technology
[NASA-SP-5926[02]] N72-25421
Survey of developments in solid lubrication
[NASA-SP-5059[01]] N72-25476
Indexes for inventory of energy research
N72-25931
Congressional hearings concerning aeronautical research
N72-25945
Federal funds for research and development for FY 1970, 71, and 72
[NSF-71-35-VOL-20] N72-25956

RESEARCH FACILITIES
NOAA satellite observations and ground support at research and data processing facilities - 1971
N72-25806
Indexes for inventory of energy research
N72-25931
Organization, personnel, funding, and facilities of National Bureau of Standards
N72-25940

RESEARCH PROJECTS
Defense, medical and industrial research in Canada for 1971
[DR-214] N72-25930
Identification of NASA contributions to advancement of major developments in selected fields of technology - Vol. I
[NASA-CR-126561] N72-25953
Research projects, applied science, and technical developments in East European scientific organizations and institutions
[JPRS-56106] N72-25959

RESIDUAL STRESS
Manufacturing process for making prespiration resistant-stress resistant biopotential electrode
[NASA-CASE-MSC-90153-2] N72-25120
Effects of production methods on residual stresses in austenite plated steel sheets
N72-25526

RESIDUES
Analysis of powder residue following one dimensional combustion and dependence on initial temperature and pressure
N72-25926

RESISTANCE
Manufacturing process for making prespiration resistant-stress resistant biopotential electrode
[NASA-CASE-MSC-90153-2] N72-25120

RESISTANCE THERMOMETERS
Platinum resistance thermometers for recording soil temperature gradient
[NASA-TT-F-14262] N72-25425

RESISTOJET ENGINES
Properties of ZrO2, ThO2, and ZrB2 and potential for use in advanced biowaste resistojets
[NASA-CR-112075] N72-25547

RESISTORS
Accelerated stress and life tests of thick film resistors
[AD-738269] N72-25274

RESONANCE
Origin of satellite/resonance lines of boron, carbon, and nitrogen ions
[NASA-TM-X-68338] N72-25649
High resolution nonlinear spectroscopy applied to line profile of Raman resonance in hydrogen gas
[NOTA-INTERNA-349] N72-25662

RESONANT FREQUENCIES
Development of electric circuit for suppressing parasitic oscillations across inductor operating in resonant mode
[NASA-CASE-ERC-10403-1] N72-25280

RESONATORS
Computer programs for analysis and design of resonators
[REPT-16] N72-25897
RESPIRATION
Aqualung swimmers, using air and normoxic mixtures of argon and helium for breathing
[NASA-TT-F-14260] N72-25030
Respiratory gas analyzer for aircrew pulmonary function measurements
[NASA-TM-X-68370] N72-25057
Decreased resistance to infections of respiratory system in closed ecological system
[NASA-CR-115641] N72-25061
Research on biological effects of radioisotope inhalation
[LF-44] N72-25109
REUSABLE ROCKET ENGINES
Engine weight, mass properties data, and design criteria for pressure fed engine on reusable space shuttle booster
[NASA-CR-123638] N72-25700
Preliminary engineering data for liquid pressure fed engine on reusable space shuttle booster
[NASA-CR-123639] N72-25701
RHENIUM ALLOYS
Low temperature ductility and mechanical properties of molybdenum and molybdenum-rhenium alloys
[NASA-TM-X-2576] N72-25523
RIBOFLAVIN
Bioassay of flavin coenzymes
[NASA-CASE-GSC-10563-1] N72-25149
RIEMANN MANIFOLD
Riemann functions and conformal mapping for construction of complex systems
[DISS-4707] N72-25565
RIGID STRUCTURES
Lightweight rigid rectangular solar panel design utilizing improved composite sandwich of Al-core and carbon fibers
[ESRO-CR[P]-79] N72-25909
RIGID WINGS
Dynamic theory of flutter for rotation of rigid wing
[ARL/SM-332] N72-24996
RIMS
Wheel with omnidirectional movement provided by independent drives for rim elements
[NASA-CASE-MFS-21309-1] N72-25480
RING CURRENTS
Effect of ring currents on magnetospheric distortion - OGO 3 and 5 observations
[NASA-TM-X-65904] N72-25630
RING LASERS
Holographic determination of krypton laser cavity ring spectrum
[TPD-1971-0-2] N72-25264
RISK
Comparison of risk and benefits in management decision making policies
N72-25962
ROCKET ENGINE DESIGN
Engine weight, mass properties data, and design criteria for pressure fed engine on reusable space shuttle booster
[NASA-CR-123638] N72-25700
Preliminary engineering data for liquid pressure fed engine on reusable space shuttle booster
[NASA-CR-123639] N72-25701
Overview of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123664] N72-25705
Summary of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123667] N72-25706
Planning documentation associated with feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123666] N72-25707
Final cost estimates for engine configurations and schedules selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123673] N72-25708
Design data book for engine system and subsystems selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123674] N72-25709
ROCKET EXHAUST
Analysis of Apollo spacecraft systems of thermal protection from engine-plume environments for application to future spacecraft programs
[NASA-TN-D-6844] N72-25922
ROCKET-BORNE INSTRUMENTS
Electronic systems of multiwire proportional counter to measure extra-solar X ray fluxes during Black Brant 4 flight
[NASA-CR-115509] N72-25743
ROCKS
Optical diffraction for two-dimensional Fourier amplitude transformation in study of rock fabrics and deformation
[AD-737390] N72-25408
RODS
Eigenvalue curves for rods vibrating under buckling loads
[REPT-107] N72-25883
Finite element method in dynamic structural analysis on axisymmetric vibrating cylinders
[REPT-106] N72-25884
ROOM TEMPERATURE
Methods of attaining sufficient pressure for metallic hydrogen at room temperature
[JPRS-56130] N72-25692
ROOTS OF EQUATIONS
Development of convergent iteration procedure for determining roots of polynomials and computer program for machine calculation of complex series
[DISS-4653] N72-25566
ROTARY WINGS
Vortex model for calculating airstream at rotor blade of helicopter
[NASA-TT-F-14228] N72-24990
Analysis of leading edge flow separation resulting from airfoils oscillating in uniform flow field at low Reynolds numbers
[AD-738304] N72-25320
ROTATING CYLINDERS
Hydrodynamic forces on oscillating cylinder with trailing vortices
N72-25293
ROTATING DISKS
Vibration mode and noise spectra of rotating disks including noise reduction of circular saws
[INRS-14/RE-A] N72-25908
ROTATING ENVIRONMENTS
Coriolis force effect on stability of rotating magnetic stars in hydrostatic equilibrium
[NASA-TM-X-65899] N72-25831
ROTATING SHAFTS
Development of Hall effect transducer for converting mechanical shaft rotations into proportional electrical signals
[NASA-CASE-LAR-10620-1] N72-25255
Mathematical model for stability analysis on rotating uneven shafts under torsional stress
[DISS-4623] N72-25477
ROTOR AERODYNAMICS
Vortex model for calculating airstream at rotor blade of helicopter
[NASA-TT-F-14228] N72-24990
ROTOR BLADES
Application of state transition matrix for numerical analysis of stability and gust response of lifting rotor with rigid flapping blades and rigid hub
N72-25001
ROTOR BLADES [TURBOMACHINERY]
Rotor head, rotor blade, transmission, and Rolls Royce 360 engine studies
[AD-737611] N72-25014
RUBY LASERS
Development and characteristics of optical equipment for collimation of laser energy
[AD-738288] N72-25509
RUNWAY CONDITIONS
Improved aircraft ground performance in slush and wet runway conditions by addition of extra nose wheel
[ARC-CP-1206] N72-25009

S

SAFEGUARD SYSTEM
Hearings before House Committee on budget requests for Army, Safeguard, and Defense Agencies construction
N72-25944
SAFETY DEVICES
Restraint torso for increased mobility and reduced physiological effects while wearing pressurized suits
[NASA-CASE-MSC-12397-1] N72-25119
SAFETY FACTORS
Worst case failure analysis on explosive package for lunar seismology experiment
N72-25980
Systems analysis for consumer product safety standards
N72-25982
Systems analysis for safety design of automobiles and highways
N72-25984
Safety effectiveness analysis for large complex system
N72-25985
Safety engineering in design and testing of tracked air cushion research vehicle
N72-25987
Safety analysis aspects in production engineering for transportation systems
N72-25988
SAFETY MANAGEMENT
Accident preventing functions of National Transportation Safety Board
N72-25958
Papers presented at conference on system safety in government and industry
[NASA-TM-X-68369] N72-25961
Application of systems theory to safety management
N72-25963
System safety assessment and current application in aerospace
N72-25968
Educational programs for improvement and management of flight system safety
N72-25970
Application of system safety engineering principles to industrial engineering
N72-25971
Methodological approach to managing system safety
N72-25972
Use of management techniques and modern safety engineering to achieve safety requirements in contractual agreements
N72-25973
Air safety program for aircraft manufacturers
N72-25974
Systems engineering and system safety management
N72-25975
Safety management plan for Viking project management project management
N72-25976
Systems analysis during operational phase
N72-25977
Management of confidence limits in lunar module design
N72-25978
Safety procedures for manned and unmanned spacecraft
N72-25979
Hazard prediction analysis for safety management in operation of rail transportation systems
N72-25983
SAMPLING
Design and development of two types of atmosphere sampling chambers
[NASA-CASE-NPO-11373] N72-25323
Checkout of multipoint sampling rake and exhaust emission of turbofan engines
[PB-207321] N72-25593
SANDS
Deformation behavior of saturated sand in triaxial compression and extension tests
[REPT-60] N72-25880
SANDWICH STRUCTURES
Lightweight rigid rectangular solar panel design utilizing improved composite sandwich of Al-core and carbon fibers
[ESRO-CR[P]-79] N72-25909
SATELLITE ANTENNAS
Conference on technological developments in satellite communications, tracking, antenna arrays, attitude control, orbit calculations, and instrumentation
[NASA-SP-295] N72-25755
SATELLITE ATTITUDE CONTROL
Conference on technological developments in satellite communications, tracking, antenna arrays, attitude control, orbit calculations, and instrumentation
[NASA-SP-295] N72-25755
Stabilization and control test facility for OAO spacecraft
N72-25791
SATELLITE OBSERVATION
Computation of gravimetric Eurasia, North Atlantic, and United States geoid from satellite and surface gravity derived data
[NASA-TM-X-65884] N72-25344
Inversion algorithm for satellite radiometric observations
N72-25376
Utilization of satellite meteorological observations for climatological research
[NASA-TT-F-723] N72-25582
Quasi-objective method for deriving 500-mb geopotential heights with aid of satellite cloud observations
[NOAA-TR-NESS-55] N72-25583
Possible circular sun-synchronous orbits for earth observatory satellites
[NASA-TM-X-65907] N72-25825
SATELLITE ORBITS
Effects of earth gravity on synchronous orbit satellite altitude
N72-25761
Possible circular sun-synchronous orbits for earth observatory satellites
[NASA-TM-X-65907] N72-25825
SATELLITE ROTATION
Computer program for simulating spinning mode of orbiting flexible spacecraft
N72-25762
SATELLITE TRACKING
Range sum and range-rate sum techniques for tracking synchronous satellites
N72-25760
Improvements in laser range noise and bias for satellite tracking
N72-25792
Photographic tracking and orbit calculation of cosmos 268 to determine upper atmosphere zonal wind speeds
[RAE-TR-71202] N72-25838

SATELLITE TRANSMISSION
Four element antenna array as ground support for superhigh frequency downlink from satellite
N72-25772
Thick film field effect transistor circuits for space flight data processing system
N72-25774
SATELLITE-BORNE INSTRUMENTS
Proposed NASA experiment for spaceborne clock system to develop new atomic frequency standards technology and improve international time and frequency comparisons
[NASA-CR-122394] N72-25423
Conference on technological developments in satellite communications, tracking, antenna arrays, attitude control, orbit calculations, and instrumentation
[NASA-SP-295] N72-25755
SATELLITE-BORNE PHOTOGRAPHY
Effects of focal plane shutter and image motion compensation on Lunar Orbiter photography
N72-25415
SATURN [PLANET]
Interior structure of Jupiter and other giant planets
N72-25818
SATURN 5 LAUNCH VEHICLES
Computerized optimal control for synthesis of load relief control system of Saturn 5 derivative launch vehicle
[NASA-CR-123646] N72-25465
SAWS
Vibration mode and noise spectra of rotating disks including noise reduction of circular saws
[INRS-14/RE-A] N72-25908
SCALE MODELS
Wind tunnel determination of directional and lateral stability and interference effects of cruise engine location on 0.015 scale space shuttle booster
[NASA-CR-120019] N72-25859
SCANNERS
Scanning electron microscope for detection of metallization defects in semiconductor devices
N72-25803
SCATTERING
Signal scattering by turbulent irregularities
N72-25369
SCATTERING CROSS SECTIONS
Photonuclear reactions and nuclear cross sections
[AD-738005] N72-25666
SCHLIEREN PHOTOGRAPHY
Mathematical models and numerical analysis of coherent optical systems used as holographic schlieren system
N72-25496
SCIENCE
Glossary and extended definitions of terms used in science policy
N72-25934
SCINTILLATION
Optical measurements of magnitude of scintillation as function of range and refractive index structure coefficient in near earth environment
N72-25354
SEA WATER
Marine biocidal properties of elastomer compounds and sea water exposure tests
[REPT-496] N72-25550
SEALING
Segmented sealing surface in valve seat
[NASA-CASE-NPO-10606] N72-25451
SEALS [STOPPERS]
Mathematical models for analyzing quasi-one-dimensional flow across face seals and narrow slots of turbine engines
[NASA-TN-D-6668] N72-25468
SEDIMENTS
Prototype tools and geophysical identification and classification of sea floor sediments
[AD-737282] N72-25406
SEISMIC WAVES
Mathematical models for determining teleseismic travel time
[AD-737405] N72-25404
SEMICONDUCTOR DEVICES
Development of process for forming insulating layer between two electrical conductor or semiconductor materials
[NASA-CASE-LEW-10489-1] N72-25447
Multiterminal Gunn-type semiconductor microwave generator for producing stable signals
[NASA-CASE-XER-07895] N72-25679
Numerical analysis for optimal dimensions of semiconductors in cryogenic systems
[DISS-4656] N72-25690
Scanning electron microscope for detection of metallization defects in semiconductor devices
N72-25803
SEMICONDUCTORS [MATERIALS]
Acoustic velocity, lattice vibrations, and magnetic permeability of A15 phase in superconducting intermetallic compounds
N72-25686
SENSORIMOTOR PERFORMANCE
Sensory and motor psychology studies with trained animals
N72-25081
SENSORY DEPRIVATION
Homing behavior of salamanders subjected to sensory impairment and manipulative techniques
N72-25092
SEPARATED FLOW
Heat transfer rate in hypersonic turbulent separated flow
[IC-AERO-72-05] N72-25310
SEQUENCING
MOD 2 sequential function generator for multibit sequence, with two-bit shift register for each pair of bits
[NASA-CASE-NPO-10636] N72-25210
SEQUENTIAL ANALYSIS
Binary coded sequential acquisition ranging system for distance measurements
[NASA-CASE-NPO-11194] N72-25209
SERVICE LIFE
Two phase program of high cycle life 30 A-h sealed AgO-Zn battery
[NASA-CR-126969] N72-25026
Service life and performance of one man electrochemical CO2 concentrator
[NASA-CR-114426] N72-25134
Development and fabrication of long life magnetic tape for unattended operation in spacecraft tape recorders
[NASA-CR-122402] N72-25179
SERVOCONTROL
Digital servocontrol system for random noise excitation in reverberant acoustic chamber
[NASA-CASE-NPO-11623-1] N72-25628
SERVOMECHANISMS
Characteristics of lightweight actuator for imparting linear motion using elongated output shaft
[NASA-CASE-NPO-11222] N72-25456
Digital computer technique for servo and control systems of large antennas
N72-25794
SHEAR STRENGTH
Tensile and shear strength of polyester yarns for balloon materials
[NASA-CR-2047] N72-25546
SHEAR STRESS
Critical shear stress of alkali halides containing non-agglomerated and agglomerated elastic dipoles
[NRC-TT-1544] N72-25166
Development of combined velocimeter and accelerometer based on color changes in liquid crystalline material subjected to shear stresses
[NASA-CASE-ERC-10292] N72-25410
Theoretical elastic analysis for in-plane shear of corrugated plate with curvilinear corrugations and with discrete attachments between ends of corrugations and surrounding members
[NASA-CR-2080] N72-25902
SHELL STABILITY
Numerical analysis of vibrations and stability of fluid filled shells and gas flowing through shells as viscous incompressible fluid
N72-25907
SHELL THEORY
Finite difference schemes for solving linear dynamic plate and shell equations
N72-25878
Iterative plate solution for flat shells in bending mode
[REPT-67] N72-25887
SHELLS [STRUCTURAL FORMS]
Yield criteria for shell surfaces
[TN-1] N72-25891
Optimal design of plates and shells for global behavioral constraints
[REPT-109] N72-25894
SHIFT REGISTERS
MOD 2 sequential function generator for multibit sequence, with two-bit shift register for each pair of bits
[NASA-CASE-NPO-10636] N72-25210
SHOCK TUBES
Nonequilibrium dissociated oxygen flow generated by shock wave in glow discharge tube
N72-25295
Mass spectrometry measurements of hypersonic flow in shock tubes
[ISL-37/71] N72-25444
SHOCK TUNNELS
Flow analysis in 1-MJ electric arc shock tunnel at Mach 7 to 19
[NASA-TN-D-6865] N72-25290
SHOCK WAVE PROPAGATION
Nonequilibrium dissociated oxygen flow generated by shock wave in glow discharge tube
N72-25295
SHOCK WAVES
Analysis of effects of aircraft maneuvers on characteristics of sonic boom and application of analysis method to various aircraft - Vol. I
[AD-735296] N72-25011
Integral methods for predicting characteristics of laminar boundary layer-shock wave interactions
[IC-AERO-72-01] N72-25312
Molecular relaxation equilibrium conditions behind reflected shock waves with tables for carbon dioxide and nitrous oxide
[ARC-CP-1201] N72-25316
Radiative heat transfer effects behind reflected shock waves in air and nitrogen
[NASA-CR-126726] N72-25917
SHORT CIRCUITS
Relationship of dislocations of silicon to solar cell current loss at low temperature
[NASA-TM-X-68055] N72-25023
SHORT TAKEOFF AIRCRAFT
Evaluation of STOL modular instrument landing system
[FAA-NA-72-11] N72-25605
SIGNAL ANALYZERS
Development of family of frequency to amplitude converters for frequency analysis of complex input signal waveforms
[NASA-CASE-MSC-12395] N72-25257
SIGNAL DETECTORS
Underground nuclear explosion infrasonic frequency detection noting supersonic signals
[KGO-722] N72-25393
SIGNAL GENERATORS
Development of Hall effect transducer for converting mechanical shaft rotations into proportional electrical signals
[NASA-CASE-LAR-10620-1] N72-25255
Sideband modulating technique for generating UHF signals used in laboratory interference tests
[BBC-1972/15] N72-25416
Instrument landing system simulator including special signal generator for environment simulation
[RAE-TR-71145] N72-25607
Digital servocontrol system for random noise excitation in reverberant acoustic chamber
[NASA-CASE-NPO-11623-1] N72-25628
Multiterminal Gunn-type semiconductor microwave generator for producing stable signals
[NASA-CASE-XER-07895] N72-25679
SIGNAL PROCESSING
Neurophysiological analysis of echolocation and signal processing in bats
N72-25083
Effect of middle ear muscle contractions on hearing and echo processing in Mustache Bat
N72-25084
Echolocation mechanisms in marine mammals
N72-25086
Development and characteristics of telemetry system using computer-accessed circuits and remotely controlled from ground station
[NASA-CASE-NPO-11358] N72-25172
Digital processors for improving optimum performance of MTI
[AD-738298] N72-25201
Signal and data processing technology for diagnostic techniques in phonocardiography
N72-25801
Design of lunar module signal conditioning, caution and warning, and data storage electronics instrumentation subsystems
[NASA-TN-D-6845] N72-25856
SIGNAL RECEPTION
Analysis of performance of path diversity satellite-to-ground millimeter wave link
[NASA-CR-122395] N72-25180
Electromechanical actuator for producing mechanical force and/or motion in response to electrical signals
[NASA-CASE-NPO-11738-1] N72-25269
Input signal measurement using liquid crystalline elements
[NASA-CASE-ERC-10275] N72-25680
SIGNAL TO NOISE RATIOS
Development of idler feedback system to reduce electronic noise problem in two parametric amplifiers
[NASA-CASE-LAR-10253-1] N72-25258
Calculation of diffraction efficiency and signal-to-noise ratio for two dimensional and volume diffuse-signal-beam holograms
N72-25500
SIGNAL TRANSMISSION
Analysis of performance of path diversity satellite-to-ground millimeter wave link
[NASA-CR-122395] N72-25180
Development and characteristics of television multiplexing system using single crystal controlled clock for synchronization of signals
[NASA-CASE-KSC-10654-1] N72-25184
Automatic and manual checkout equipment for testing space vehicle signal transmission lines
[NASA-CASE-KSC-10385] N72-25211
Two atmospheric probing experiments, involving beyond-the-horizon propagation of microwave signals
N72-25368
Signal scattering by turbulent irregularities
N72-25369
Process for computing least squares polynomial approximation of data points and transmission media computer program
[NASA-CR-126970] N72-25563

SILICON TRANSISTORS
Vapor deposition method for forming metallized tungsten contacts on silicon substrates
[NASA-CASE-GSC-10695-1] N72-25259
Computer aided two dimensional analysis of silicon metal Schottky gate field effect transistor transport equation
[DISS-4661] N72-25271
Development of method and apparatus for detecting surface ions on silicon diodes and transistors
[NASA-CASE-ERC-10325] N72-25457
SILOXANES
Synthesis of siloxane containing epoxide and diamine polymers
[NASA-CASE-MFS-13994-2] N72-25148
Silphenylenesiloxane polymer with in-chain perfluoroalkyl groups
[NASA-CASE-MFS-20979] N72-25151
SILVER
Dry electrode manufacture, using silver powder with cement
[NASA-CASE-FRC-10029-2] N72-25121
SILVER ZINC BATTERIES
Two phase program of high cycle life 30 A-h sealed AgO-Zn battery
[NASA-CR-126969] N72-25026
Solar cell activated silver zinc battery for interplanetary flight
N72-25767
SIMULATORS
Development of procedures for exposing aviators to effects of spatial disorientation in ground based simulator
N72-25045
Development and characteristics of simulation facility for analyzing communication systems
[AD-738297] N72-25200
Cylindrical chamber for simulating three dimensional flow in steady state hurricane
N72-25286
SINGLE CRYSTALS
Development and characteristics of magnetometer with single Bi2Se3 crystal as sensing element
[NASA-CASE-LEW-11632-1] N72-25440
Hyperfine structure in crystal calcium tungstate determined by combination of electron paramagnetic resonance and electron nuclear double resonance techniques
[NASA-CR-126751] N72-25683
Gravity influenced parameters affecting solidification and crystal growth in tin
[NASA-TM-X-53999] N72-25693
SINGLE SIDEBAND TRANSMISSION
Measurements of harmonic distortion of sinusoidally modulated carrier using envelope and asymmetric sideband detectors
[BBC-1972/13] N72-25176
SITTING POSITION
Behavior of gluteal region of human body subjected to varying loads in sitting position
[AD-737225] N72-25110
SKY WAVES
Lack of dependence of low frequency, sky wave field strength variations during nighttime on solar activity in Europe
[BBC-1972/12] N72-25731
SKYLAB PROGRAM
Safety procedures for manned and unmanned spacecraft
N72-25979
SLOT ANTENNAS
Omnidirectional antenna array with circumferential slots for mounting on cylindrical space vehicle
[NASA-CASE-LAR-10163-1] N72-25247
SLOTS
Mathematical models for analyzing quasi-one-dimensional flow across face seals and narrow slots of turbine engines
[NASA-TN-D-6668] N72-25468
SLURRIES
Edge and surface modification of niobium alloys, silicon coating, and slurry composition modification
[NASA-TM-X-68052] N72-25543
SLUSH
Improved aircraft ground performance in slush and wet runway conditions by addition of extra nose wheel
[ARC-CP-1206] N72-25009
SNAP
Design and performance analyses of SNAP 199 fuel element core
[AI-AEC-13017] N72-25618
SOCIAL FACTORS
Social, economic, and physical impact of high energy physics accelerator laboratory on environment
[WASH-1505] N72-25291
SODIUM
Annual variations of upper atmospheric sodium abundance based on dust particle temperature
N72-25396
SODIUM CHLORIDES
Anodic and cathodic passivation of aluminum electrode in AlCl3-KCl-NaCl melts between 100 and 160 C
[NASA-CR-126727] N72-25153
SOILS
Platinum resistance thermometers for recording soil temperature gradient
[NASA-TT-F-14262] N72-25425
Mechanical behavior of fine soils in lunar environment in engineering gravity flow bins
[BM-RI-7543] N72-25472
Small displacement, strain, finite element technique, using constant strain triangle for gravity flow of powder
[BM-RI-7577] N72-25473
SOLAR ACTIVITY
Aerospace environment requirements for spacecraft operations, including information on solar activity, geomagnetic field, radiation dosage, and star catalogs
N72-25239
Solar activity variation of ionospheric ion composition and variation of NO[plus]/O[plus] ratio during day in E and F regions
[RSD-67] N72-25719
Lack of dependence of low frequency, sky wave field strength variations during nighttime on solar activity in Europe
[BBC-1972/12] N72-25731
Theory on origin of solar system
N72-25751
SOLAR ARRAYS
Lightweight rigid rectangular solar panel design utilizing improved composite sandwich of Al-core and carbon fibers
[ESRO-CR[P]-79] N72-25909
SOLAR ATMOSPHERE
Basic physical properties involved in large-scale structure of solar interior and atmospheric layers
N72-25811
SOLAR CELLS
Apparatus for applying thin glass slides to solar cells
[NASA-CASE-NPO-10575] N72-25019
Cost effectiveness of solar cell space power systems
[NASA-TM-X-68054] N72-25022
Relationship of dislocations of silicon to solar cell current loss at low temperature
[NASA-TM-X-68055] N72-25023
SOLAR CONSTANT
Revised standard values for solar constant and solar spectrum
N72-25787
SOLAR CORONA
IMP 4 data on coronal transport of flare associated scatter-free electron events and two-dimensional diffusion model
[NASA-TM-X-65887] N72-25724
Basic physical properties involved in large-scale structure of solar interior and atmospheric layers
N72-25811
Hydrodynamics and thermodynamics of corona and its expansion into interplanetary space, and flare-produced shock wave propagation
N72-25814
SOLAR COSMIC RAYS
Temporal variations, energy spectrum, and directional properties of solar cosmic rays studied with Pioneer 8 and 9 data
N72-25716
SOLAR FLARES
IMP 4 data on coronal transport of flare associated scatter-free electron events and two-dimensional diffusion model
[NASA-TM-X-65887] N72-25724
Hydrodynamics and thermodynamics of corona and its expansion into interplanetary space, and flare-produced shock wave propagation
N72-25814
Interplanetary plasma diagnostics and solar wind observations during normal and disturbed times
N72-25815
SOLAR INSTRUMENTS
Precision digital solar aspect sensor
N72-25782
SOLAR PHYSICS
Radio and space research 1968-1970, including upper ionosphere, energetic particles, and solar physics studies
[NP-19177] N72-25198
Solar physics, planetary atmospheres, comets, and earth aurora and upper atmosphere, studied with satellite, rocket, and space probe data
N72-25805
Solar system, solar physics, planetary atmospheres and structure, and origin of planets and moon - conference
[NASA-SP-300] N72-25810
Basic physical properties involved in large-scale structure of solar interior and atmospheric layers
N72-25811
Rotation of deep solar interior based on observed oblateness, implied gravitational quadrupole moment, slow solar wind braking, and Li depletion and lack of Be depletion
N72-25812
Evolution of solar rotation rate, solar fluid dynamics, braking, spin-down, and effects of instabilities
N72-25813
Hydrodynamics and thermodynamics of corona and its expansion into interplanetary space, and flare-produced shock wave propagation
N72-25814
SOLAR POSITION
Directional orientation of dragonfly relative to azimuth of sun
N72-25094
SOLAR RADIATION
Geophysics and space data
[AD-738327] N72-25397
SOLAR RADIO EMISSION
Detection method for intensity of hydrogen 3 cm and 21 cm lines in radio spectrum of sun
[AD-737850] N72-25839
SOLAR ROTATION
Rotation of deep solar interior based on observed oblateness, implied gravitational quadrupole moment, slow solar wind braking, and Li depletion and lack of Be depletion
N72-25812
Evolution of solar rotation rate, solar fluid dynamics, braking, spin-down, and effects of instabilities
N72-25813
SOLAR SPECTRA
Revised standard values for solar constant and solar spectrum
N72-25787
Detection method for intensity of hydrogen 3 cm and 21 cm lines in radio spectrum of sun
[AD-737850] N72-25839
SOLAR SYSTEM
Theory on origin of solar system
N72-25751
Solar system, solar physics, planetary atmospheres and structure, and origin of planets and moon - conference
[NASA-SP-300] N72-25810
Theories of solar system origin, emphasizing primitive nebula and accretion
N72-25821
SOLAR WIND
Electric current production in magnetosphere and energy transfer from solar wind to magnetosphere
[NASA-TM-X-65893] N72-25340
Solar wind model having electrons and protons at same temperature near sun and proton thermal anisotropy beyond 0.4 AU
N72-25720
Abundances in sun and solar wind and estimates of deuterium and helium 3 in protosolar gas
N72-25725
Rotation of deep solar interior based on observed oblateness, implied gravitational quadrupole moment, slow solar wind braking, and Li depletion and lack of Be depletion
N72-25812
Interplanetary plasma diagnostics and solar wind observations during normal and disturbed times
N72-25815
Trapped solar wind rare gases and isotope ratios for Apollo 12 fines and Apollo 11 breccia
N72-25833
SOLDERED JOINTS
Gold embrittlement in flight connector soldered joints
[JPL-TM-33-533] N72-25522
SOLID LUBRICANTS
Survey of developments in solid lubrication
[NASA-SP-5059[01]] N72-25476
SOLID PROPELLANT IGNITION
Feasibility of forced convection ignition tests on cartridge powder
[TL-1971-16] N72-25919
Thermodynamic and gas dynamic properties of solid ammunition ignition
[TL-1971-17] N72-25920
SOLID ROCKET PROPELLANTS
Development of torsional pendulum apparatus for determining effects of vacuum on mechanical properties of two ablator materials
[NASA-CR-2074] N72-25548
Solid propellant stabilizer containing nitroguanidine
[NASA-CASE-NPO-12000] N72-25699
SOLID STATE DEVICES
Characteristics of solid state ruby laser and application for holographic recording
N72-25502
SOLIDIFICATION
Solidification time of metal drops in vacuum, considering heat removal by radiation and evaporation
[RM-544] N72-25532
Gravity influenced parameters affecting solidification and crystal growth in tin
[NASA-TM-X-53999] N72-25693
SOLIDS
Computerized simulation for construction and calculation of properties of particulate solids in two and three dimensional systems
[BM-BULL-658] N72-25228
SONAR
Effects of sonar headset echo ranging on hearing effects in sonar technicians
[AD-737207] N72-25113

SONIC BOOMS
Analysis of effects of aircraft maneuvers on characteristics of sonic boom and application of analysis method to various aircraft - Vol. 1
[AD-735296] N72-25011
SOUND FIELDS
Method for computing noise generated by standing and flying jet aircraft
[ONERA-NT-187] N72-25636
SOUND GENERATORS
Airborne sound generated by splitter-type damper air flow, as function of air velocity
[RVO-A70/KM/116] N72-25633
SOUND PRESSURE
Effects of random excitation on cavity pressure and panel vibrations
[NASA-CR-112051] N72-25623
SOUND RANGING
Neurophysiological analysis of echolocation and signal processing in bats
N72-25083
Echolocation mechanisms in marine mammals
N72-25086
Operational characteristics of dolphin hydrolocator system
N72-25107
Effects of sonar headset echo ranging on hearing effects in sonar technicians
[AD-737207] N72-25113
SOUND WAVES
Use of acoustic waves for remote probing of lower atmosphere
N72-25384
Atmospheric propagation of sound waves at infrasonic frequencies
N72-25385
Infrasound used for probing upper atmosphere structure and motion
[REPT-1245] N72-25387
Measurement of sound attenuation after impact of steel balls on plates
[REPT-7107.521] N72-25625
Focusing finite-amplitude cylindrical and spherical sound waves in viscous and heat conducting medium
[NASA-CR-112095] N72-25631
SOUTHERN HEMISPHERE
Eole monitoring of drifting buoys and balloons in Southern Hemisphere for oceanographic and meteorological data
[NASA-TT-F-14279] N72-25345
SPACE COMMUNICATION
Analysis of performance of path diversity satellite-to-ground millimeter wave link
[NASA-CR-122395] N72-25180
SPACE EXPLORATION
Operational principles of international cooperation in space exploration - conference
[S-DOC-92-57] N72-25951
International liability and space exploration
N72-25957
SPACE FLIGHT
Plant cultivation in closed ecological system in space flight
[JPRS-56129] N72-25106
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 15 May 1972
[JPRS-55985] N72-25824
Soviet bloc research in astronomy, meteorology, oceanography, geology, and space science - 1 June 1972
[JPRS-56154] N72-25834
Experiments for determining potential uses of future deep space missions in studies of relativistic gravity
[NASA-CR-126746] N72-25928
SPACE MISSIONS
Design of multispectral infrared line scanner for use on a space shuttle earth resources mission
[REPT-779/72/1-VOL-2-SUMM] N72-25446
SPACE NAVIGATION
Revised documentation pertaining to computation requirements for guidance, navigation, and control of space shuttle orbiter vehicle
[NASA-TM-X-68367] N72-25872
Revised specifications of baseline set of equations necessary to perform guidance, navigation, and control functions during orbital operations of space shuttle orbiter
[NASA-TM-X-68368] N72-25873
SPACE ORIENTATION
Effects of specialized auditory stimuli on human performance of spatial orientation tasks
[AD-737351] N72-25112
SPACE SHUTTLE BOOSTERS
APU for providing hydraulic and electric power to space shuttle booster and orbiter
[NASA-CR-1994] N72-25024
Engine weight, mass properties data, and design criteria for pressure fed engine on reusable space shuttle booster
[NASA-CR-123638] N72-25700
Preliminary engineering data for liquid pressure fed engine on reusable space shuttle booster
[NASA-CR-123639] N72-25701
Overview of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123664] N72-25705
Summary of results obtained in analyses of candidate pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123667] N72-25706
Planning documentation associated with feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123666] N72-25707
Final cost estimates for engine configurations and schedules selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123673] N72-25708
Design data book for engine system and subsystems selected in feasibility study of pressure-fed engine for water recoverable space shuttle booster
[NASA-CR-123674] N72-25709
Optimization technique, problem formulation, and results obtained in design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123644] N72-25843
Mathematical models used in application of modern optimal control techniques to design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123645] N72-25844
Wind tunnel determination of directional and lateral stability and interference effects of cruise engine location on 0.015 scale space shuttle booster
[NASA-CR-120019] N72-25859
SPACE SHUTTLE ORBITERS
APU for providing hydraulic and electric power to space shuttle booster and orbiter
[NASA-CR-1994] N72-25024
Supersonic aerodynamic characteristics of space shuttle orbiter 040A [Mach 2.0 to 4.0]
[NASA-CR-120033] N72-25858
Heat transfer tests of delta wing orbiter vehicle model in hypervelocity wind tunnel
[NASA-CR-120024] N72-25863
Phase B extension baseline system for inertial subsystem functional and design requirements for orbiter, using GNC computer
[NASA-CR-115662] N72-25867
Revised documentation pertaining to computation requirements for guidance, navigation, and control of space shuttle orbiter vehicle
[NASA-TM-X-68367] N72-25872
Revised specifications of baseline set of equations necessary to perform guidance, navigation, and control functions during orbital operations of space shuttle orbiter
[NASA-TM-X-68368] N72-25873
Orbiter characteristics of three-engined external hydrogen tank orbiter/heat sink booster, space shuttle concept
[NASA-CR-115654] N72-25874
Development of analytic model and procedure for estimating probability distributions of touchdown conditions for space shuttle orbiter vehicle
[NASA-CR-114465] N72-25875
SPACE SHUTTLES
Environmental control/life support system for four-man, seven-day orbital shuttle
[NASA-CR-1981] N72-25126
Orifice efficiencies for air flow into compartment from flowing external stream
[NASA-CR-61383] N72-25305
Design of multispectral infrared line scanner for use on space shuttle earth resources mission, noting equipment specifications
[REPT-779/72/1-VOL-1] N72-25445
Design of multispectral infrared line scanner for use on a space shuttle earth resources mission
[REPT-779/72/1-VOL-2-SUMM] N72-25446
Automatic flare and decrab guidance and control system for space shuttles
[NASA-CR-114436] N72-25599
Strategy and logic used in space shuttle on-orbit rendezvous target program, for circular orbits
[NASA-CR-123713] N72-25836
Fracture control criteria applicable to space shuttle structures
[NASA-SP-8055] N72-25851
Design requirements of sortie module located in space shuttle bay
[NASA-TM-X-64668] N72-25854
Development of analytic model and procedure for estimating probability distributions of touchdown conditions for space shuttle orbiter vehicle
[NASA-CR-114465] N72-25875
Development of method for determining buckling characteristics of disposable liquid hydrogen tank used on space shuttles
[RM-540] N72-25906
SPACE STATIONS
Multiple in-line docking capability having intermeshing docking turrets for rotating space stations
[NASA-CASE-MFS-20855-1] N72-25853
SPACE SUITS
Device for regulating and monitoring pneumatic pressure in underwater space suit
[NASA-CASE-MFS-20332-2] N72-25124
Automatic temperature control for liquid cooled space suit
[NASA-CASE-ARC-10599-1] N72-25129
SPACE VEHICLE CHECKOUT PROGRAM
Design development and acceptance checkout testing programs for Apollo spacecraft
[NASA-TN-D-6857] N72-25475
SPACEBORNE ASTRONOMY
Solar physics, planetary atmospheres, comets, and earth aurora and upper atmosphere, studied with satellite, rocket, and space probe data
N72-25805
SPACEBORNE TELESCOPES
Designing three meter class large space telescopes
[NASA-TM-X-68824] N72-25422
Design optimizations of space astronomical telescopes with nested geometries
N72-25779
SPACECRAFT ANTENNAS
Development of large, furlable spacecraft antennas using conical main reflectors with two and four reflection configurations
[NASA-CR-126966] N72-25193
Omnidirectional antenna array with circumferential slots for mounting on cylindrical space vehicle
[NASA-CASE-LAR-10163-1] N72-25247
Orbital stability of Radio Astronomy Explorer satellite having four antenna booms
N72-25759
SPACECRAFT CABIN ATMOSPHERES
Effects of toxic methyl isobutyl ketone vapor on physiological processes in dogs, monkeys, and rats during 90 day continuous exposure
[NASA-CR-126744] N72-25102
SPACECRAFT CABINS
Design guidelines for habitability and furniture elements for extended periods in zero gravity environment
[NASA-CR-115640] N72-25862
SPACECRAFT COMMUNICATION
Flight tests of Apollo spacecraft communications systems
[NASA-TN-D-6852] N72-25186
Conference on technological developments in satellite communications, tracking, antenna arrays, attitude control, orbit calculations, and instrumentation
[NASA-SP-295] N72-25755
SPACECRAFT COMPONENTS
Development of apparatus for mounting scientific experiments in spacecraft to permit utilization without maneuvering spacecraft
[NASA-CASE-MSC-12372-1] N72-25842
Advanced techniques for determining long term performance of spacecraft liquid propulsion system components
[NASA-CR-126720] N72-25845
SPACECRAFT CONFIGURATIONS
Orbiter characteristics of three-engined external hydrogen tank orbiter/heat sink booster, space shuttle concept
[NASA-CR-115654] N72-25874
SPACECRAFT CONTAMINATION
Analytical models for analyzing probable terrestrial microbial release from unmanned Mars landing spacecraft
[NASA-CR-126846] N72-25105
Radiation field inside spacecraft using radioisotope thermoelectric generator
N72-25770
SPACECRAFT CONTROL
Satellite data acquisition and processing, noting real time operation, spacecraft control, computers, and software - conferences
[ESRO-SP-69] N72-25233
Data acquisition for spacecraft control noting data display techniques at ESOC
N72-25237
Stabilizing control systems, and controllers structured like passive mechanical systems
[NASA-TN-D-6731] N72-25277
Effects of mass product of inertia and rotor constraints on attitude stability of dual spin spacecraft
N72-25594
Development of thrust control system for application to control of aircraft and spacecraft
[NASA-CASE-MSC-13397-1] N72-25595
Optimization technique, problem formulation, and results obtained in design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123644] N72-25843
Mathematical models used in application of modern optimal control techniques to design study of aerodynamic surface control of space shuttle boost and reentry
[NASA-CR-123645] N72-25844
Methods for analysis of random effects in spacecraft control systems and for evaluating system precision
[JPRS-56134] N72-25868
Analysis method for random parametric effects in spacecraft control systems
N72-25869
Methods for evaluating precision of spacecraft control systems operating under influence of large number of perturbations
N72-25870

Revised documentation pertaining to computation requirements for guidance, navigation, and control of space shuttle orbiter vehicle
[NASA-TM-X-68367] N72-25872
Revised specifications of baseline set of equations necessary to perform guidance, navigation, and control functions during orbital operations of space shuttle orbiter
[NASA-TM-X-68368] N72-25873
SPACECRAFT DESIGN
Design guidelines for habitability and furniture elements for extended periods in zero gravity environment
[NASA-CR-115640] N72-25862
Phase B extension baseline system for inertial subsystem functional and design requirements for orbiter, using GNC computer
[NASA-CR-115662] N72-25867
Management of confidence limits in lunar module design
N72-25978
SPACECRAFT DOCKING
Multiple in-line docking capability having intermeshing docking turrets for rotating space stations
[NASA-CASE-MFS-20855-1] N72-25853
Analysis of spacecraft docking systems as designed and utilized in Apollo project
[NASA-TN-D-6854] N72-25857
SPACECRAFT ENVIRONMENTS
Development and fabrication of long life magnetic tape for unattended operation in spacecraft tape recorders
[NASA-CR-122402] N72-25179
SPACECRAFT GUIDANCE
Revised documentation pertaining to computation requirements for guidance, navigation, and control of space shuttle orbiter vehicle
[NASA-TM-X-68367] N72-25872
Revised specifications of baseline set of equations necessary to perform guidance, navigation, and control functions during orbital operations of space shuttle orbiter
[NASA-TM-X-68368] N72-25873
SPACECRAFT INSTRUMENTS
Instrument systems and experiments for forty spacecraft
[NASA-TM-X-2066] N72-25424
SPACECRAFT LANDING
Failure of parachute on Apollo 15 spacecraft during earth landing
[NASA-TM-X-68350] N72-25848
Development of analytic model and procedure for estimating probability distributions of touchdown conditions for space shuttle orbiter vehicle
[NASA-CR-114465] N72-25875
SPACECRAFT MODELS
Apollo spacecraft models used to obtain flight test and wind tunnel data on aerothermodynamic measurements at superorbital velocities
[NASA-TN-D-6843] N72-25923
SPACECRAFT MODULES
Design requirements of sortie module located in space shuttle bay
[NASA-TM-X-64668] N72-25854
Thermal control system for spacecraft modular housing with heat pipes, louvres, and wall structures providing heat transfer path from module to space
[NASA-CASE-GSC-11018-1] N72-25871
SPACECRAFT PERFORMANCE
Effects of atmospheric pressure, density, temperature, and wind variations on spacecraft stability, control, and heating
[NASA-CR-2062] N72-25336
SPACECRAFT POWER SUPPLIES
Cost effectiveness of solar cell space power systems
[NASA-TM-X-68054] N72-25022
University generated designs for spacecraft electric power supplies
[NASA-CR-2061] N72-25144
Nuclear energy systems for spacecraft power and propulsion
[NASA-TM-X-68341] N72-25612
SPACECRAFT PROPULSION
Nuclear energy systems for spacecraft power and propulsion
[NASA-TM-X-68341] N72-25612
SPACECRAFT STABILITY
Effects of mass product of inertia and rotor constraints on attitude stability of dual spin spacecraft
N72-25594
Design of satellite telecommunication system stabilized by ion thrusters
[PUBL-893] N72-25847
SPACECRAFT STRUCTURES
Fracture control criteria applicable to space shuttle structures
[NASA-SP-8095] N72-25851
Development of collapsible transparent observation window for manned spacecraft
[NASA-CR-112085] N72-25852
Development of automatically adjusted thermal control coating to compensate for changes in thermal balance of spacecraft
[NASA-TN-D-6756] N72-25924
SPACECRAFT TRACKING
Ionospheric bias correction methods in radio tracking of spacecraft
N72-25756
Two-element antenna array to measure gain improvement for spacecraft tracking
N72-25796
SPAIN
Geomagnetic measurements in Spain for 1969
N72-25338
SPECIFIC HEAT
Ac susceptibility, dc magnetization, and specific heat capacity methods for measuring superconducting properties of fast frozen In-Ga alloys
[TID-25864] N72-25694
SPECTRAL REFLECTANCE
Spectroscopic analysis of vibration spectra and spectral reflectance in AlO3La, AlO3Pr, and AlO3Nd
N72-25685
SPECTROMETERS
Spectrometer with superheterodyne receiver for high resolution electron paramagnetic and molecular rotation-spectroscopy
[DISS-4673] N72-25272
Development and characteristics of gamma ray spectrometer for measurement of intense radiation using Compton scattering effect
[NASA-CASE-MFS-21441-1] N72-25427
Chemical analysis of copper base alloys using X ray spectrographs and radioisotope X ray analyzer
[BM-RI-7635] N72-25520
SPECTROSCOPIC ANALYSIS
Spectroscopic analysis of vibration spectra and spectral reflectance in AlO3La, AlO3Pr, and AlO3Nd
N72-25685
SPECTROSCOPY
Potential of laser radar as ground based remote sensor of atmosphere
[CONTRIB-62] N72-25358
SPECTRUM ANALYSIS
Noise levels and spectral analysis for Vidraria Company in Sao Paulo, Brazil
[TR-7201.561] N72-25620
Origin of satellite/resonance lines of boron, carbon, and nitrogen ions
[NASA-TM-X-68338] N72-25649
Measurement of scintillations of small diameter and large diameter radio sources in several stars
N72-25740
SPEECH
Methods and digital computer system for automated speech output
N72-25139
SPHERICAL WAVES
Spherical wave expansion method for synthesizing fields of feed for spherical reflector
N72-25177
SPIN EXCHANGE
Geometrical model for epsilon production noting pion exchange
[NOTA-INTERNA-357] N72-25664
SPIN STABILIZATION
Effects of mass product of inertia and rotor constraints on attitude stability of dual spin spacecraft
N72-25594
SPINE
Radiological spinal examination of combat pilots and limiting angle for scoliosis
N72-25056
SPOILERS
Unsteady response of turbocompressor with inlet flow distorted by square wave and triangular spoilers
[ARC-CP-1203] N72-25000
SPUTTERING
Proceedings of conference on sputtering and ion plating
[NASA-SP-5111] N72-25470
STABILITY
Geomagnetic tail noise caused by electron instability in neutral sheet
[AD-738316] N72-25398
Effect of coriolis force on stability of rotating hydromagnetic systems and condition for instability
[NASA-TM-X-65908] N72-25826
STABILITY DERIVATIVES
Analysis of techniques and computer programs for extracting stability derivative information from flight test records
[NASA-CR-2016] N72-24991
Application of state transition matrix for numerical analysis of stability and gust response of lifting rotor with rigid flapping blades and rigid hub
N72-25001
Development of Liapunov functional for continuous, nonconservative systems with damping
[REPT-66] N72-25886
STABILIZATION
Stabilizing control systems, and controllers structured like passive mechanical systems
[NASA-TN-D-6731] N72-25277
High magnetic field superconducting materials and stabilization methods
[IPP-4/91] N72-25696
STABILIZERS [AGENTS]
Solid propellant stabilizer containing nitroguanidine
[NASA-CASE-NPO-12000] N72-25699
STADAN [SATELLITE TRACKING NETWORK]
Ground data processing requirements for Ariel satellites
N72-25242
STANDARDS
Findings of US government study group on advantages and problems associated with converting industry and science to metric system of measurements
N72-25469
Revised standard values for solar constant and solar spectrum
N72-25787
Organization, personnel, funding, and facilities of National Bureau of Standards
N72-25940
STARS
Characteristics of faint stars at high galactic latitudes determined by UBV photometry
N72-25417
STATISTICAL ANALYSIS
Statistical analysis of mission profiles for passenger- and cargo-transport aircrafts
[TB-88] N72-25002
Review of U.S. general aviation accidents for 1969
[NTSB-ARG-71-1] N72-25004
Application of statistical analysis techniques for determining orientation and navigation characteristics of animals
N72-25066
Factors contributing to attrition from active airman status, particularly biological and medical characteristics
[FAA-AM-72-13] N72-25104
Linear statistical inversion from ground based microwave probing
N72-25372
Statistical method for objectively producing forecasts of daily maximum temperatures from numerical model output
[NOAA-TM-NWS-TDL-45] N72-25581
Statistical analysis of radiation intensity in emission spectroscopy
[EUR-4716] N72-25655
STATISTICAL DISTRIBUTIONS
Method to derive statistical characterizations of perturbations imposed upon wave propagating through random medium such as earth atmosphere
N72-25349
STATISTICS
Statistical modeling for predicting events and trends of complex systems
N72-25136
STEADY STATE
Phase stability of bond type metallic binary systems
[NPL-DCS-15] N72-25697
STEELS
Ultrasonic inspection of cast steel rings
[REPT-7105.510] N72-25449
Ultrasonic tests of large steel castings
[TR-7202.568] N72-25460
Effects of production methods on residual stresses in austenite plated steel sheets
N72-25526
Brittle fracture and cracks in steels, joints, and metal sheets
[JPRS-56070] N72-25527
Brittle fracture analysis of medium alloy steels for electroslag welded ship components
N72-25528
Static bending tests and brittleness of medium alloy steel
N72-25529
Influence of cracks on tensile strength of steel test bar and on strength and plasticity of aluminum alloys
N72-25530
Tendency toward brittleness in low alloy steels
N72-25531
STELLAR EVOLUTION
Jeans criterion and formation of stars within nucleus of quasar
[FRNC-TH-138] N72-25657
Abundances in sun and solar wind and estimates of deuterium and helium 3 in protosolar gas
N72-25725
Evolution of stellar models with helium envelopes
N72-25733
Star formation from galactic clouds
[REPT-101] N72-25749
STELLAR LUMINOSITY
Masses, radii, and luminosities of RR Lyrae variable stars
[BULL-170] N72-25747
STELLAR MASS
Masses, radii, and luminosities of RR Lyrae variable stars
[BULL-170] N72-25747
STELLAR RADIATION
Measurement of scintillations of small diameter and large diameter radio sources in several stars
N72-25740

STELLAR SPECTRA
Li-6/Li-7 ratio for F, G, and early K field stars determined theoretically and with Fabry-Perot interferometer
N72-25735
Spectra in 2 micron atmospheric window for late-type dwarfs, giants, supergiants, and long-period variables
N72-25739
Spectral line constants, solar equivalent widths, and desaturated values for late stars
[BULL-168] N72-25746
STELLAR SPECTROPHOTOMETRY
Photometric and photographic data used to identify new faint blue stars and study longitudinal distributions of interstellar absorption, H I, and H II across Carina spiral feature
N72-25736
STIFFENING
Optimum shape and size for edge stiffeners for thin walled compression elements
[TN-7] N72-25893
STIFFNESS
Stiffness and mass matrices for laminated, anisotropic, quadrilateral thin shell, based on kinetic and strain energy principles
N72-25876
STOCHASTIC PROCESSES
Stochastic stability, invariance theorems, and systems with randomly varying coefficients
[CDS-TR-72-2] N72-25559
STOICHIOMETRY
Nondestructive gamma-gamma coincidence counting, radiochemical, and substoichiometric separation methods for determination of noble metals in meteorites
N72-25511
STONY METEORITES
Mineralogical composition of fusion crust of Kunashak stony meteorite
[NASA-TT-F-14269] N72-25752
STRAIN GAGES
Strain gage data and techniques for D-38 test beams electroplated with nickel and gold
[UCRL-51169] N72-25443
STRAIN RATE
Effects of temperature, grain size, and strain rate on fracture behavior of Inconel alloy X-750
[TN-11] N72-25905
STRATOSPHERE
Vertical distribution of stratospheric methane by balloon-borne infrared spectrometers
[AERONOMICA-ACTA-A-97-1972]
N72-25837
STRESS [PHYSIOLOGY]
Analysis of spatial disorientation reports by flying personnel during 14 year period
[NASA-CR-126786] N72-25032
Behavior of gluteal region of human body subjected to varying loads in sitting position
[AD-737225] N72-25110
Methodology and analysis of visual evoked cortical response as measure of stress in hyperbaric atmospheres of naval environment emphasizing slow flash rates
[AD-737209] N72-25115
STRESS CYCLES
Electron microscopic examination of dislocation structure in alternately stressed austenitic steels
[NASA-TT-F-14267] N72-25521
STRESS FUNCTIONS
Maxwell stress function solution for three dimensional elasticity problem
[REPT-79] N72-25888
STRESS WAVES
Development of theory for propagation of elastic-plastic waves in truncated conical shells
[AD-737100] N72-25910
STRESS-STRAIN DIAGRAMS
Effect of age hardening on stress-strain curves
[RAE-LIB-TRANS-1525] N72-25525
Deformation behavior of saturated sand in triaxial compression and extension tests
[REPT-60] N72-25880
STRESSES
Accelerated stress and life tests of thick film resistors
[AD-738269] N72-25274
Finite element for linear static stress analysis of thin elastic shells
[NRC-12624] N72-25900
STRUCTURAL ANALYSIS
Computer program for solving heat transfer problems by optical structural analysis
N72-25763
Development of Liapunov functional for continuous, nonconservative systems with damping
[REPT-66] N72-25886
Development of method for determining buckling characteristics of disposable liquid hydrogen tank used on space shuttles
[RM-540] N72-25906
STRUCTURAL DESIGN
Safety engineering in design and testing of tracked air cushion research vehicle
N72-25987
STRUCTURAL ENGINEERING
Mechanics, acoustics, ultrasonics, radio, and structural engineering research
N72-25626
STRUCTURAL FAILURE
Electron microscopic examination of dislocation structure in alternately stressed austenitic steels
[NASA-TT-F-14267] N72-25521
STRUCTURAL STABILITY
Mathematical model for stability analysis on rotating uneven shafts under torsional stress
[DISS-4623] N72-25477
Validity of energy criterion in predicting critical load stability of continuous system
[REPT-63] N72-25885
Galerkin stability analysis on critical loads of polygenic systems using Kelvin model and external damping
[REPT-102] N72-25890
STRUCTURAL STRAIN
Manual for computer analysis of structural strain and hypervelocity impacts
[NASA-CR-126749] N72-25219
STRUCTURAL VIBRATION
Multiple eigenvalue analysis on structural vibrations of linear systems with estimation of frequency boundary stability
[REPT-43] N72-25881
Finite element method in dynamic structural analysis on axisymmetric vibrating cylinders
[REPT-106] N72-25884
SUBMARINES
Methodology and analysis of visual evoked cortical response as measure of stress in hyperbaric atmospheres of naval environment emphasizing slow flash rates
[AD-737209] N72-25115
SUBREFLECTORS
Dichroic subreflector for Rosman 2 dish antenna
N72-25795
SUBSONIC SPEED
Measurement of base pressure fluctuations at subsonic and supersonic speeds on flared bodies with flat or hemispherical noses
[ARC-CP-1204] N72-24997
SULFUR COMPOUNDS
Mercaptan terminated polymer containing sulfonic acid salts of nitrosubstituted aromatic amines for heat and moisture resistant coatings
[NASA-CASE-ARC-10325] N72-25147
SULFUR OXIDES
High altitude balloon flights to measure SO2 and NO2 gases in earth atmosphere using absorption spectroscopy
[NASA-CR-115639] N72-25343
SUN
Abundances in sun and solar wind and estimates of deuterium and helium 3 in protosolar gas
N72-25725
SUNLIGHT
Use of sunlight as underwater visual direction finder by fishes
N72-25089
SUNSPOTS
Galactic cosmic ray intensity, sunspot number, 10.7 cm radio flux, and geomagnetism
[AD-737848] N72-25728
SUPERCONDUCTING MAGNETS
Residual field theory for superconducting dipoles and quadrupole magnets
[KFK-EXT-3/71-10] N72-25695
High magnetic field superconducting materials and stabilization methods
[IPP-4/91] N72-25696
SUPERCONDUCTIVITY
Quantum interference fluxmeter with superconducting sensor having circuit loop with sharp constrictions, for measuring weak magnetic fields
N72-25431
Proximity effects for superconducting and normal metals
[NASA-CR-126771] N72-25682
Ac susceptibility, dc magnetization, and specific heat capacity methods for measuring superconducting properties of fast frozen In-Ga alloys
[TID-25864] N72-25694
SUPERCONDUCTORS
Band model calculation for electron phonon coupling in intermetallic A15 compounds
N72-25644
SUPERHEATING
Corrosion resistance of cold worked austenitic CrNi steels and Ni alloys in superheated steam
[EURFNR-954] N72-25534
SUPERHETERODYNE RECEIVERS
Spectrometer with superheterodyne receiver for high resolution electron paramagnetic and molecular rotation-spectroscopy
[DISS-4673] N72-25272
SUPERHIGH FREQUENCIES
Analytical and empirical procedures for pre-emphasis determination of S band constant bandwidth FM/FM station
[NASA-TM-X-64648] N72-25182
Circuitry and electrical performance of solid state Ku band IMPATT diode amplifier
[NASA-CR-122426] N72-25270
Four element antenna array as ground support for superhigh frequency downlink from satellite
N72-25772
Discrete component amplifier for superhigh frequencies
N72-25773
SUPERSONIC AIRCRAFT
Analysis of effects of aircraft maneuvers on characteristics of sonic boom and application of analysis method to various aircraft - Vol. I
[AD-735296] N72-25011
SUPERSONIC JET FLOW
Supersonic jet flow distribution from convergent nozzles
[ARC-CP-1197] N72-25315
SUPERSONIC SPEEDS
Measurement of base pressure fluctuations at subsonic and supersonic speeds on flared bodies with flat or hemispherical noses
[ARC-CP-1204] N72-24997
SUPERSONIC WIND TUNNELS
Supersonic aerodynamic characteristics of space shuttle orbiter 040A [Mach 2.0 to 4.0]
[NASA-CR-120033] N72-25858
SURFACE IONIZATION
Development of method and apparatus for detecting surface ions on silicon diodes and transistors
[NASA-CASE-ERC-10325] N72-25457
SURFACE PROPERTIES
Edge and surface modification of niobium alloys, silicon coating, and slurry composition modification
[NASA-TM-X-68052] N72-25543
SURFACE REACTIONS
Effects of Gibbsian adsorbed layers and insoluble films on film forming mechanism of liquid mercury surfaces
[NASA-CR-120884] N72-25158
SURFACE STABILITY
Yield criteria for shell surfaces
[TN-1] N72-25891
SURFACES
Numerical analysis of nonhomogeneous flow in two dimensional propulsive lifting system
N72-25296
SURVEYS
Man-portable laser beacon and receiver system for land survey
N72-25802
SWEDEN
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Apr. - June 1971
N72-25390
Polar ionospheric geophysical data recorded at Kiruna, Sweden, during Jul. - Sep. 1971
N72-25391
Polar upper atmosphere data recorded at Kiruna Geophysical Observatory, Sweden, from Oct. - Dec. 1971
N72-25394
SWITCHING CIRCUITS
Characteristics of noise immune switching gates with hysteresis loops
N72-25266
SYMBOLS
Human factors engineering applied to development of radar symbology and discrimination in mixed displays for cathode ray tube presentation
[AD-738132] N72-25204
SYNCHRONOUS SATELLITES
Development of device for simulating charge and discharge cycle of battery in synchronous orbit
[NASA-CASE-GSC-11211-1] N72-25020
Range sum and range-rate sum techniques for tracking synchronous satellites
N72-25760
Effects of earth gravity on synchronous orbit satellite altitude
N72-25761
SYNOPTIC METEOROLOGY
Synoptic meteorological weather charts of Northern Hemisphere for November, 1971
N72-25576
SYSTEM EFFECTIVENESS
Service life and performance of one man electrochemical CO2 concentrator
[NASA-CR-114426] N72-25134
System performance of FDM systems using subcarrier channel frequencies from 4 to 200 kHz and channel information bandwidths of dc to 1, 2, 4, 8 and 16 kHz
[NASA-CR-123580] N72-25275
Physical characteristics, and system effectiveness of high power airborne military illuminating sources
[AD-737832] N72-25678
Educational programs for improvement and management of flight system safety
N72-25970

SYSTEMS ANALYSIS
Main methods of fuel flow measurement and factors for consideration in deciding on type of meter to use for various requirements
[AGARDOGRAPH-160-VOL-3] N72-25420
Analysis of spacecraft docking systems as designed and utilized in Apollo project
[NASA-TN-D-6854] N72-25857
Analysis of Apollo spacecraft systems of thermal protection from engine-plume environments for application to future spacecraft programs
[NASA-TN-D-6844] N72-25922
System safety assessment and current application in aerospace N72-25968
Systems analysis during operational phase N72-25977
Systems analysis for consumer product safety standards N72-25982
Hazard prediction analysis for safety management in operation of rail transportation systems N72-25983
Safety effectiveness analysis for large complex system N72-25985
Safety analysis aspects in production engineering for transportation systems N72-25988

SYSTEMS COMPATIBILITY
Systems engineering and system safety management N72-25975

SYSTEMS ENGINEERING
Fabrication and operational procedures for processing lunar samples in sterile nitrogen atmosphere
[NASA-TN-D-6858] N72-25099
Development of regenerable or partially regenerable life support systems use in EVA protective systems
[NASA-CR-114382] N72-25133
University generated designs for spacecraft electric power supplies
[NASA-CR-2061] N72-25144
Design and operation of dual-mode multispectral scanner system satisfying both overland and oceanographic requirements
[NASA-CR-126721] N72-25334
Development of light sensing system for controlled orientation of object relative to sun or other light source
[NASA-CASE-NPO-11311] N72-25414
Development of thrust control system for application to control of aircraft and spacecraft
[NASA-CASE-MSC-13397-1] N72-25595
Design of satellite telecommunication system stabilized by ion thrusters
[PUBL-893] N72-25847
Design of lunar module signal conditioning, caution and warning, and data storage electronics instrumentation subsystems
[NASA-TN-D-6845] N72-25856
Orbiter characteristics of three-engined external hydrogen tank orbiter/heat sink booster, space shuttle concept
[NASA-CR-115654] N72-25874
Design, development, and performance of lunar module landing gear subsystem
[NASA-TN-D-6850] N72-25903
Application of systems theory to safety management N72-25963
Application of system safety engineering principles to industrial engineering N72-25971
Methodological approach to managing system safety N72-25972
Use of management techniques and modern safety engineering to achieve safety requirements in contractual agreements N72-25973
Systems engineering and system safety management N72-25975
Systems analysis for safety design of automobiles and highways N72-25984

SYSTEMS MANAGEMENT
Applicability of NASA contract quality management and failure mode effect analysis procedures to USGS Outer Continental Shelf oil and gas lease management program
[NASA-TM-X-2567] N72-25955

SYSTOLIC PRESSURE
Automatic system for measuring and monitoring systolic and diastolic blood pressure in humans
[NASA-CASE-MSC-13999-1] N72-25142

T

TABLES [DATA]
Analysis of emissions from aircraft piston and gas turbine engines - tables
[PB-207107] N72-25589
Table of gamma ray energies and intensities from radioactive isotopes produced by [n,gamma] reactions
[IRI-133-71-06] N72-25661

TANGENTS
Integrated circuit tangent function generator
[NASA-CASE-MSC-13907-1] N72-25281

TANKS [CONTAINERS]
Development of method for determining buckling characteristics of disposable liquid hydrogen tank used on space shuttles
[RM-540] N72-25906

TANTALUM ALLOYS
Thermomechanical and thermochemical behavior of high temperature, oxidation resistant, hafnium-20 percent tantalum alloy
[NASA-TM-X-68339] N72-25524

TAPE RECORDERS
One-channel portable tape recording system for long term ECG recording of flying personnel N72-25051
Analog computer program for analysis of extended electrocardiographic monitoring N72-25053
Development and fabrication of long life magnetic tape for unattended operation in spacecraft tape recorders
[NASA-CR-122402] N72-25179

TDR SATELLITES
Four element antenna array as ground support for superhigh frequency downlink from satellite N72-25772

TECHNOLOGY ASSESSMENT
Conference on technological developments in satellite communications, tracking, antenna arrays, attitude control, orbit calculations, and instrumentation
[NASA-SP-295] N72-25755

TECHNOLOGY TRANSFER
Aerospace technology transfer to biomedical research problems, including transfer innovations and potential applications
[NASA-CR-126773] N72-25101
Nondestructive testing technology transfer based on information obtained from NASA reliability engineering programs
[NASA-CR-126574] N72-25482
Identification of NASA contributions to advancement of major developments in selected fields of technology - Vol. 1
[NASA-CR-126561] N72-25953
Contributions of NASA programs to specific fields of technology - Vol. 2
[NASA-CR-126562] N72-25954

TECHNOLOGY UTILIZATION
Developments in measurement technology
[NASA-SP-5926[02]] N72-25421
Survey of developments in solid lubrication
[NASA-SP-5059[01]] N72-25476
Nondestructive testing technology transfer based on information obtained from NASA reliability engineering programs
[NASA-CR-126574] N72-25482
Technological approaches to education N72-25941
Readings on science, technology, and economy, and presidential economic policy N72-25942
Identification of NASA contributions to advancement of major developments in selected fields of technology - Vol. 1
[NASA-CR-126561] N72-25953
Contributions of NASA programs to specific fields of technology - Vol. 2
[NASA-CR-126562] N72-25954

TELECOMMUNICATION
Telecommunications system design for Mariner Mars 1971 spacecraft, emphasizing modifications to accommodate orbital mission
[NASA-CR-126968] N72-25192
Design of satellite telecommunication system stabilized by ion thrusters
[PUBL-893] N72-25847

TELEMETRY
Development and characteristics of telemetry system using computer-accessed circuits and remotely controlled from ground station
[NASA-CASE-NPO-11358] N72-25172
Transmission, recording, and processing of data telemetered from WRESAT satellite
[WRE-TN-516-[T]] N72-25195
Telemetry remote module for data transmission to central control core N72-25775
Logic system for design and fabrication of telemetry ground data processing equipment N72-25797

TELEVISION EQUIPMENT
Development and characteristics of television multiplexing system using single crystal controlled clock for synchronization of signals
[NASA-CASE-KSC-10654-1] N72-25184

TELEVISION RECEPTION
Descriptors of textural scenes and spatial relationships between grey levels in TV picture
[TR-184] N72-25188
Threshold effects in FM TV and low cost community TV reception via satellite N72-25785

TELEVISION TRANSMISSION
Analysis of allowable error rate in pulse code modulation system used with color television signal transmission
[BBC-1972/14] N72-25175
Sideband modulating technique for generating UHF signals used in laboratory interference tests
[BBC-1972/15] N72-25416

TEMPERATURE CONTROL
Automatic temperature control for liquid cooled space suit
[NASA-CASE-ARC-10599-1] N72-25129
Thermal control system for spacecraft modular housing with heat pipes, louvres, and wall structures providing heat transfer path from module to space
[NASA-CASE-GSC-11018-1] N72-25871

TEMPERATURE DISTRIBUTION
Effect of corrected thermal conductivity expression on temperature distribution in protonosphere
[NASA-TM-X-65900] N72-25339
Thermal finite element computer program for variance analysis on predicted temperature field N72-25764

TEMPERATURE EFFECTS
Development of laser testing technique for determining zero shift and change in sensitivity of pressure transducer
[NBS-TN-723] N72-25487
Thermal compatibility of production grade [Pu-238]O2 and nickel and cobalt base alloys
[MLM-1864] N72-25535
Thermal distortion and static bending plus twist measurements on deployable boom structures for spacecraft N72-25789
Development of automatically adjusted thermal control coating to compensate for changes in thermal balance of spacecraft
[NASA-TN-D-6756] N72-25924

TEMPERATURE GRADIENTS
Platinum resistance thermometers for recording soil temperature gradient
[NASA-TT-F-14262] N72-25425

TEMPERATURE MEASURING INSTRUMENTS
Development of thermopiles with larger receiving area for improved correlation of light and energy measurements
[NRC-TT-1550] N72-25027

TEMPERATURE PROFILES
Highly convergent relaxation method for temperature profile determination in atmosphere N72-25375
Vertical profiles of wind and temperature by remote acoustical sounding N72-25386
Line shape and band structure effects on radiative equilibrium temperature profile in planetary atmospheres and method for treating nongrey radiative transfer problems
[NASA-TM-X-6509] N72-25827

TENSILE PROPERTIES
Creep, tensile and thermal properties, and microstructure of Zn-Al alloys
[BM-RI-7538] N72-25518

TENSILE STRENGTH
Influence of cracks on tensile strength of steel test bar and on strength and plasticity of aluminum alloys N72-25530
Tensile strength and creep properties of fiber/epoxy resin composites
[NASA-TM-X-68053] N72-25544
Tensile and shear strength of polyester yarns for balloon materials
[NASA-CR-2047] N72-25546

TERMINAL FACILITIES
Requirements for channel splitting to accommodate increased VHF omnirange navigation instrument landing systems, and distance measuring equipment facilities
[PAPER-54-71/SC122-3] N72-25502

TERRAIN
Universal system for assigning colors to terrain
[AGARD-AG-159] N72-25346

TEST CHAMBERS
Computer program for automatic determination of gases in environmental chamber during spacecraft testing N72-25788

TEST EQUIPMENT
Design and development of two types of atmosphere sampling chambers
[NASA-CASE-NPO-11373] N72-25323
Design, development, and installation of high pressure oxygen impact tester
[NASA-CR-123643] N72-25418
Proceedings of conference on applications of laser technology for aerodynamic measurements
[AGARD-LS-49] N72-25493
Mathematical models and numerical analysis of coherent optical systems used as holographic schlieren system N72-25496

Principles for producing holograms and methods of recording interference pattern between reference beam and reflected light waves
N72-25499
Development and characteristics of holography cameras for use with Q switched ruby lasers
[NASA-CR-126767] N72-25501
Development of torsional pendulum apparatus for determining effects of vacuum on mechanical properties of two ablator materials
[NASA-CR-2074] N72-25548
Development of apparatus for testing burning rate and flammability of materials
[NASA-CASE-XMS-09690] N72-25913

TEST FACILITIES
Design and operation of IMBLMS
[NASA-CR-115664] N72-25143
Real time auxiliary computing facility for carrying out mission support and simulation programs during Apollo project
[NASA-TN-D-6855] N72-25223
Social, economic, and physical impact of high energy physics accelerator laboratory on environment
[WASH-1505] N72-25291
Stabilization and control test facility for OAO spacecraft
N72-25791
Test facility for analyzing pogo phenomenon in liquid fuel launch vehicles
N72-25841
Magnetic test facility used for magnetic field and torque measurements of UK 4 prototype spacecraft
[NASA-TM-X-65890] N72-25861
Feasibility of forced convection ignition tests on cartridge powder
[TL-1971-16] N72-25919

TEST STANDS
Micropound extended range thrust stand
N72-25790
Vibration measurements on walls of turbojet test facility
[TL-1971-11] N72-25898

TEXTURES
Descriptors of textural scenes and spatial relationships between grey levels in TV picture
[TR-184] N72-25188

THEOREM PROVING
Proving of Boltzmann limit conjecture for two- and three-dimensional Lorentz gas with hard core molecular collisions
[NOTA-INTERNA-358] N72-25638

THEORETICAL PHYSICS
Nuclear research and development projects
[KFK-1550] N72-25989

THERMAL CONDUCTIVITY
Thermal instability in differentially heated inclined fluid layers and unstable base flow in conduction regime
[REPT-44] N72-25299
Effect of corrected thermal conductivity expression on temperature distribution in protonosphere
[NASA-TM-X-65900] N72-25339
Thermal performance tests for variable conductance heat pipe
[NASA-CR-123652] N72-25916
Proceedings of conference on thermal conductivity
[CONF-710938] N72-25927

THERMAL CONDUCTORS
Focusing finite-amplitude cylindrical and spherical sound waves in viscous and heat conducting medium
[NASA-CR-112095] N72-25631

THERMAL CONTROL COATINGS
Mercaptan terminated polymer containing sulfonic acid salts of nitrosubstituted aromatic amines for heat and moisture resistant coatings
[NASA-CASE-ARC-10325] N72-25147
Bibliographic survey of series emittance thermal control coatings including materials properties and resistance to radiation
[ONERA-DERTS-NT-03-8] N72-25554
Damage to thermal aluminum coating caused by short wavelength ultraviolet radiation
N72-25769
Analysis of thermophysical properties of thermal control coatings used on Apollo 9 flight
[NASA-TN-D-6863] N72-25864
Development of automatically adjusted thermal control coating to compensate for changes in thermal balance of spacecraft
[NASA-TN-D-6756] N72-25924

THERMAL DIFFUSION
Nonstationary states of isotope mixtures in thermal diffusion columns
N72-25667

THERMAL ENVIRONMENTS
Thermal control system for spacecraft modular housing with heat pipes, louvres, and wall structures providing heat transfer path from module to space
[NASA-CASE-GSC-11018-1] N72-25871

THERMAL EXPANSION
Application of spiral, bimetallic strip to create circular motion on mechanical shaft by changing strip temperature
[NASA-CASE-NPO-11283] N72-25260

THERMAL INSTABILITY
Thermal instability in differentially heated inclined fluid layers and unstable base flow in conduction regime
[REPT-44] N72-25299

THERMAL POLLUTION
Design and development of remote sensors for oceanographic experiments on marine biology and thermal pollution
[AD-737348] N72-25405

THERMAL PROTECTION
Thermal aspects of using filamentary composite materials for airframes on atmospheric entry spacecraft
[SD-72-SH-0015] N72-25542
Analysis of Apollo spacecraft systems of thermal protection from engine-plume environments for application to future spacecraft programs
[NASA-TN-D-6844] N72-25922

THERMAL STRESSES
Development of device for simulating cyclic thermal loading of flexible materials by application of mechanical stresses and deformations
[NASA-CASE-LAR-10270-1] N72-25877
Proceedings of conference on thermal conductivity
[CONF-710938] N72-25927

THERMAL VACUUM TESTS
Thermal vacuum tests of TBC-1 power performance at 715 and 935 C hot shoe temperatures
[TID-25901] N72-25616

THERMIONIC CONVERTERS
Alternative schemes for providing closed loop reactor control in thermionic reactor systems
[NASA-CR-126868] N72-25610

THERMIONIC EMITTERS
Performance of uranium nitride fueled converters with rhenium or tungsten emitters
[NASA-CR-126864] N72-25609

THERMIONIC POWER GENERATION
Electron energy plasma ion density, and electric potential in simulated thermionic energy converter
[NASA-CR-126866] N72-25668

THERMODYNAMIC PROPERTIES
Design and development of isotope heat source to meet requirements of steady-state operation and atmospheric entry
[NASA-TN-D-6833] N72-24994
Thermomechanical and thermochemical behavior of high temperature, oxidation resistant, hafnium-20 percent tantalum alloy
[NASA-TM-X-68339] N72-25524
Analysis of thermophysical properties of thermal control coatings used on Apollo 9 flight
[NASA-TN-D-6863] N72-25864
Numerical analysis of heat transfer limitations for heat pipes operating at high and low temperatures
[NASA-CR-126739] N72-25915
Development of theory for interfacial thermal conductance between two heated metal plates in direct contact
[NASA-CR-126743] N72-25921
Numerical analysis of radiant heat flux and local energy loss of line in region of strong variations of source function in one direction
[NASA-CR-126965] N72-25925

THERMODYNAMICS
Aerothermodynamic integration model, including flow paths, leading edges, and ducts
[NASA-CR-112059] N72-25714

THERMOELECTRIC GENERATORS
Radiation field inside spacecraft using radioisotope thermoelectric generator
N72-25770

THERMOELECTRIC POWER GENERATION
Thermal vacuum tests of TBC-1 power performance at 715 and 935 C hot shoe temperatures
[TID-25901] N72-25616

THERMOELECTRICITY
Development of thermopiles with larger receiving area for improved correlation of light and energy measurements
[NRC-TT-1550] N72-25027

THERMOGRAVIMETRY
Nonisothermal thermogravimetry of decomposition reactions for copper sulfate and oxysulfate in flowing nitrogen and air
[BM-RI-7638] N72-25519

THERMOLUMINESCENCE
Factors affecting design of albedo-neutron dosimeters, using Li-6 and Li-7 thermoluminescent dosimetry systems
[LA-4832] N72-25442

THERMONUCLEAR REACTIONS
Components of initial nuclear radiation field from intermediate yield thermonuclear weapon
[ORNL-TM-3396] N72-25660

THERMOPILES
Development of thermopiles with larger receiving area for improved correlation of light and energy measurements
[NRC-TT-1550] N72-25027

THICK FILMS
Accelerated stress and life tests of thick film resistors
[AD-738269] N72-25274
Conductive thick film inks, including unfired inks
[NASA-CR-126973] N72-25688
Thick film circuitry for brushless motor commutator and control
N72-25766
Thick film field effect transistor circuits for space flight data processing system
N72-25774

THIN FILMS
Waveguide, thin film window and microwave irises
[NASA-CASE-LAR-10513-1] N72-25170
Design of oligatomic thin film computer storage device
[NASA-CR-123635] N72-25213

THIN WALLED SHELLS
Stiffness and mass matrices for laminated, anisotropic, quadrilateral thin shell, based on kinetic and strain energy principles
N72-25876
Finite element for linear static stress analysis of thin elastic shells
[NRC-12624] N72-25900

THIN WALLS
Low mass truss structure with elongated thin-walled tubular segments
[NASA-CASE-LAR-10546-1] N72-25287

THORIUM COMPOUNDS
Properties of ZrO2, ThO2, and ZrB2 and potential for use in advanced biowaste resistojets
[NASA-CR-112075] N72-25547

THREE BODY PROBLEM
Initial and final state mechanisms of sequential three-body reactions and angular distribution of disintegration products
[DISS-4684] N72-25651

THREE DIMENSIONAL FLOW
Cylindrical chamber for simulating three dimensional flow in steady state hurricane
N72-25286
Maxwell stress function solution for three dimensional elasticity problem
[REPT-79] N72-25888

THRESHOLD GATES
Amplitude limiters and trigger switches with biased diodes for threshold stabilization of alternating voltage
N72-25265

THRESHOLDS
Threshold effects in FM TV and low cost community TV reception via satellite
N72-25785

THRUST
Micropound extended range thrust stand
N72-25790

THRUST CONTROL
Lunar module 5 reaction control system performance during descent and ascent
[NASA-TM-X-68342] N72-25846

THRUST VECTOR CONTROL
Development of thrust control system for application to control of aircraft and spacecraft
[NASA-CASE-MSC-13397-1] N72-25595

TIME MEASUREMENT
Mathematical models for determining teleseismic travel time
[AD-737405] N72-25404
Development of system for automatic time synchronization based on Loran system timing networks
[RR-104] N72-25598

TIMING DEVICES
Modulo-M counter for digital subsystem for generating spacecraft timing and control signals
[NASA-CR-126971] N72-25276

TIN
Gravity influenced parameters affecting solidification and crystal growth in tin
[NASA-TM-X-53999] N72-25693

TITANIUM
Role of hydrogen in formation of massive voids during electron beam welding of titanium and effect of various treatments on hydrogen contamination and elimination
[RM-545] N72-25481
Near ultraviolet spectra and Zeeman effects of iron and titanium containing corundum crystals
[DISS-4600] N72-25689

TOPOGRAPHY
Analysis of effects of topography on homing ability of pigeons as determined by ground release and helicopter tracking
N72-25077

TORQUEMETERS
Magnetic test facility used for magnetic field and torque measurements of UK 4 prototype spacecraft
[NASA-TM-X-65890] N72-25861

TORSION
Development of torsional pendulum apparatus for determining effects of vacuum on mechanical properties of two ablator materials
[NASA-CR-2074] N72-25548

TORSIONAL STRESS
Mathematical model for stability analysis on rotating uneven shafts under torsional stress
[DISS-4623] N72-25477

TORSO
Restraint torso for increased mobility and reduced physiological effects while wearing pressurized suits
[NASA-CASE-MSC-12397-1] N72-25119

TOUCH
Measuring method for cutaneous perception using instrument with elongated tubular housing
[NASA-CASE-MSC-13609-1] N72-25122

TOWING
Simulated towed cable systems of nylon and steel strands, and two mathematical models for towline performance
N72-25730

TOXICOLOGY
Effects of toxic methyl isobutyl ketone vapor on physiological processes in dogs, monkeys, and rats during 90 day continuous exposure
[NASA-CR-126744] N72-25102

TRACKING [POSITION]
Development and application of instrumentation for tracking movements of sea turtles and polar bears
N72-25064
Development and application of radio telemetry equipment for tracking migration of birds
N72-25065
Application of statistical analysis techniques for determining orientation and navigation characteristics of animals
N72-25066
Electronic equipment and techniques for using satellite systems to track animals to determine migratory and navigation behavior
N72-25068

TRAJECTORY CONTROL
Analysis of proportional navigation system used for missile guidance and comparison with theoretical system
[AASU-313] N72-25597

TRANSDUCERS
Electronic equipment and systems used to track wild animals in order to determine migratory and navigational behavior
N72-25067
Development of laser testing technique for determining zero shift and change in sensitivity of pressure transducer
[NBS-TN-723] N72-25487

TRANSFER ORBITS
Numerical algorithm for determining optimal plane changes of three impulse transfers between noncoplanar circular orbits
[NASA-TM-X-64662] N72-25809
Apollo spacecraft models used to obtain flight test and wind tunnel data on aerothermodynamic measurements at superorbital velocities
[NASA-TN-D-6843] N72-25923

TRANSFORMERS
Fail-safe multiple transformer circuit configuration
[NASA-CASE-NPO-11078] N72-25262

TRANSISTOR AMPLIFIERS
Discrete component amplifier for superhigh frequencies
N72-25773

TRANSMISSION LINES
Automatic and manual checkout equipment for testing space vehicle signal transmission lines
[NASA-CASE-KSC-10385] N72-25211

TRANSMITTER RECEIVERS
Location identification system with ground based transmitter and aircraft borne receiver/decoder
[NASA-CASE-ERC-10324] N72-25173

TRANSMITTERS
Operational characteristics of dolphin hydrolocator system
N72-25107
Transmitter subsystem drawings for DC/EC digital test system
[NASA-CR-115597] N72-25230
System inputs, transmitter, and receiver of DC/EC digital system tests
[NASA-CR-115606] N72-25231

TRANSPARENCE
Plasma diagnostics, using monoenergetic potassium beam for transparency measurements
[EUR-CEA-FC-615] N72-25669

TRANSPORT PROPERTIES
Computer aided two dimensional analysis of silicon metal Schottky gate field effect transistor transport equation
[DISS-4661] N72-25271
Transport properties and microwave emission in n-type InSb at liquid nitrogen temperature
N72-25684
IMP 4 data on coronal transport of flare associated scatter-free electron events and two-dimensional diffusion model
[NASA-TM-X-65887] N72-25724

TRANSPORTATION
Hearings concerning FY 72 transportation appropriations
N72-25946
Accident preventing functions of National Transportation Safety Board
N72-25958
Safety analysis aspects in production engineering for transportation systems
N72-25988

TREES [PLANTS]
Infrared radiometer and video scan system for remote sensing of root rot disease in Pacific Northwest Douglas fir tree population
[NASA-CR-126719] N72-25029
Organic materials for underwater protection of timber attacked by shipworms
[REPT-498] N72-25549

TRIANGLES
Contouring algorithms over triangular meshes for contour map making
[NPL-NAC-10] N72-25245

TROPOSPHERE
Transhorizon propagation or tropospheric scatter as possible tools for remote sensing in atmosphere
N72-25367

TRUSSES
Low mass truss structure with elongated thin-walled tubular segments
[NASA-CASE-LAR-10546-1] N72-25287

TUNGSTEN
Chemisorption of Co on tungsten III surface
N72-25157
Vapor deposition method for forming metallized tungsten contacts on silicon substrates
[NASA-CASE-GSC-10695-1] N72-25259
Chemical compatibility between tungsten and uranium carbide alloys
[NASA-CR-126869] N72-25545

TURBINE ENGINES
Mathematical models for analyzing quasi-one-dimensional flow across face seals and narrow slots of turbine engines
[NASA-TN-D-6668] N72-25468
Analytical measurements of exhaust emissions from aircraft turbine engines using Jet A fuel
[BM-RI-7634] N72-25584

TURBOCOMPRESSORS
Unsteady response of turbocompressor with inlet flow distorted by square wave and triangular spoilers
[ARC-CP-1203] N72-25000

TURBOFAN ENGINES
Subsonic behavior of three annular airfoils for turbofan engine cowlings
[ARC-R/M-3688] N72-24999
Checkout of multipoint sampling rake and exhaust emission of turbofan engines
[PB-207321] N72-25593

TURBOJET ENGINES
Vibration measurements on walls of turbojet test facility
[TL-1971-11] N72-25898

TURBULENT BOUNDARY LAYER
Development of finite difference turbulent boundary layer computer program with consideration of mass transfer wall cooling and equilibrium chemistry effects
[NASA-CR-126728] N72-25301
Turbulent boundary layer nozzle analysis and computer program
[NASA-TM-X-64663] N72-25308
Calculation of annulus wall turbulent boundary layers in axial flow turbines noting flow deflections of blades
[ARC-CP-1196] N72-25314

TURBULENT DIFFUSION
Sea-air energy flux measurements from atmospheric budget, surface layer vertical eddy flux, and upper ocean heat budget data
[NOAA-TM-ERL-BOMAP-9] N72-25333

TURBULENT WAKES
Performance tests of acoustic radar equipment to detect vortices formed by low flying aircraft and comparison with conventional sensing methods
[FAA-RD-71-103] N72-25008
Numerical analysis of finite amplitude waves generated by aircraft trailing vortices to indicate growth of waves on pair of parallel infinite vortices
[AD-737859] N72-25012

TURNING FLIGHT
Mathematical models for describing pilot performance during multiple input-output controller tasks
[NASA-CR-112048] N72-25128

TURTLES
Factors affecting migratory habits and orientation of sea turtles
N72-25091

TWO DIMENSIONAL FLOW
Effect of cooling on near wake of two dimensional circular cylinder at Mach number 6
N72-25298

TWO PHASE FLOW
Two-phase flow system with discrete, impinging two-phase jets
[NASA-CASE-NPO-11556] N72-25292

U

UBV SPECTRA
Characteristics of faint stars at high galactic latitudes determined by UBV photometry
N72-25417

UK 4 SATELLITE
Magnetic test facility used for magnetic field and torque measurements of UK 4 prototype spacecraft
[NASA-TM-X-65890] N72-25861

ULTRAHIGH FREQUENCIES
Sideband modulating technique for generating UHF signals used in laboratory interference tests
[BBC-1972/15] N72-25416
Performance tests of L band communication concepts for air traffic control equipment installed in Applications Technology Satellite-F
[NASA-TM-X-65906] N72-25601

ULTRASONIC TESTS
Ultrasonic inspection of cast steel rings
[REPT-7105.510] N72-25449
Procedure and apparatus for ultrasonic tests of welded Y joints and Inconel tubes
[TR-7108.533] N72-25458
Ultrasonic tests of large steel castings
[TR-7202.568] N72-25460
Ultrasonic inspection of wing spar joints on Viscount aircraft
[TR-7105.512] N72-25461
Ultrasonic inspection of welded joints
[TR-6105.506] N72-25462
Bonding tests of weldment filling in forged steel axle
[TR-7103.494] N72-25463
Ultrasonic signal counting technique for flaw detection in aluminum welds
[NASA-CR-123649] N72-25464
Ultrasonic tests of cast brass billets
[REPT-7110.541] N72-25466
Instruments and procedures for ultrasonic inspection of cast bronze bars
[REPT-7009.453] N72-25467
High frequency arc discharges and pulse generation for ultrasonic tests
[NASA-CASE-MFS-21233-1] N72-25627

ULTRASONICS
Olfactory stimuli and ultrasonic signal methods for individual recognition between mother and infant brown bats
N72-25085

ULTRAVIOLET RADIATION
Bibliographic survey of series emittance thermal control coatings including materials properties and resistance to radiation
[ONERA-DERTS-NT-03-8] N72-25554

ULTRAVIOLET SPECTRA
Ultraviolet chromatographic detector for quantitative and qualitative analysis of compounds
[NASA-CASE-HQN-10756-1] N72-25428

UMBILICAL CONNECTORS
Gas operated quick disconnect coupling for umbilical connectors
[NASA-CASE-NPO-11202] N72-25450

UNDERWATER COMMUNICATION
Anatomical function of spermaceti organ in sperm whales
[CONTRIB-74] N72-25087

UNDERWATER ENGINEERING
Device for regulating and monitoring pneumatic pressure in underwater space suit
[NASA-CASE-MFS-20332-2] N72-25124
Organic materials for underwater protection of timber attacked by shipworms
[REPT-498] N72-25549

UNDERWATER OPTICS
Use of sunlight as underwater visual direction finder by fishes
N72-25089

UNITED STATES OF AMERICA
Computation of gravimetric Eurasia, North Atlantic, and United States geoid from satellite and surface gravity derived data
[NASA-TM-X-65884] N72-25344

UNITS OF MEASUREMENT
Findings of US government study group on advantages and problems associated with converting industry and science to metric system of measurements
N72-25469

UNIVERSITY PROGRAM
University generated designs for spacecraft electric power supplies
[NASA-CR-2061] N72-25144

UNSTEADY STATE
Nonstationary states of isotope mixtures in thermal diffusion columns
N72-25667

UPPER ATMOSPHERE
Optical radar observations above 30 km
N72-25359
Transhorizon radio propagation for determining upper atmospheric structure
N72-25370
Infrasound used for probing upper atmosphere structure and motion
[REPT-1245] N72-25387

Polar upper atmosphere data recorded at Kiruna Geophysical Observatory, Sweden, from Oct. - Dec. 1971
N72-25394
Annual variations of upper atmospheric sodium abundance based on dust particle temperature
N72-25396
Upper wind data, code, and tables
N72-25586
Solar physics, planetary atmospheres, comets, and earth aurora and upper atmosphere, studied with satellite, rocket, and space probe data
N72-25805

URANIUM CARBIDES
Chemical compatibility between tungsten and uranium carbide alloys
[NASA-CR-126869] N72-25545

URANUS [PLANET]
Interior structure of Jupiter and other giant planets
N72-25818

URBAN DEVELOPMENT
Appropriations hearings for housing and urban development, space science, and Veterans Administration
N72-25932

URINE
Bacteria detection of urine using bioluminescent reaction of ATP with luciferin and luciferase
N72-25800

V

VACUUM APPARATUS
Development of torsional pendulum apparatus for determining effects of vacuum on mechanical properties of two ablator materials
[NASA-CR-2074] N72-25548

VACUUM DEPOSITION
Proceedings of conference on sputtering and ion plating
[NASA-SP-5111] N72-25470

VALVES
Segmented sealing surface in valve seat
[NASA-CASE-NPO-10606] N72-25451

VANGUARD 2 SATELLITE
Numerical integration and analytical models for computing Vanguard 2 orbit
N72-25757

VAPOR DEPOSITION
Vapor deposition method for forming metallized tungsten contacts on silicon substrates
[NASA-CASE-GSC-10695-1] N72-25259

VARIABLE STARS
Masses, radii, and luminosities of RR Lyrae variable stars
[BULL-170] N72-25747

VC-10 AIRCRAFT
Fixed base simulator study of direct lift control on VC-10 aircraft
[ARC-CP-1199] N72-25010

VEHICLE WHEELS
Walking and wheel rotation capabilities of lunar transportation vehicle
N72-25285

VELOCITY MEASUREMENT
Development of combined velocimeter and accelerometer based on color changes in liquid crystalline material subjected to shear stresses
[NASA-CASE-ERC-10292] N72-25410

VERTEBRATES
Pulse modulated biotelemetry system for determining energy budgets in free-ranging vertebrates from heart rate and body temperature measurement
N72-25123

VERTICAL AIR CURRENTS
Field test evaluation of optical cross beam system for measuring convective wind velocities
N72-25382

VERTICAL DISTRIBUTION
Vertical distribution of stratospheric methane by balloon-borne infrared spectrometers
[AERONOMICA-ACTA-A-97-1972]
N72-25837

VERTIGO
Proceedings of conference on medical aspects of spatial disorientation and effects on safe aircraft operation
[AGARD-CP-95-PT-1] N72-25031
Analysis of spatial disorientation reports by flying personnel during 14 year period
[NASA-CR-126786] N72-25032
Analysis of spatial disorientation occurrences among military pilots and classification according to types of aircraft and nature of accidents
N72-25033
Analysis of military aircraft accidents caused by spatial disorientation
N72-25034
Statistical analysis of military aircraft accidents to determine incidents caused by spatial disorientation
N72-25035
Psychophysiological and environmental factors involved in aircraft accidents of military aircraft and effect of flying experience in reducing spatial disorientation
N72-25036
Effects of high intensity noise levels on human vestibular system and production of disorientation and nausea
[AMRL-TR-71-58] N72-25038
Analysis of aircraft pilot reports on occurrence of unreality and detachment during flight and relationship to spatial disorientation
N72-25042
Occurrences of vertigo in hyperbaric atmospheres and among underwater divers with theoretical explanations of etiology involved
N72-25043
Development of procedures for exposing aviators to effects of spatial disorientation in ground based simulator
N72-25045
Application of methods of simulation of instrument flying as means of reducing occurrences of spatial disorientation in flight
N72-25046
Clinical evaluation and medical treatment of spatial disorientation problems in flying personnel
N72-25047
Aptitude for recovery from vertigo in flying personnel
N72-25059

VERY HIGH FREQUENCIES
Apollo VHF ranging system development program
[NASA-TN-D-6851] N72-25187

VESTIBULAR TESTS
Physiological tests of vestibulo-ocular reflex by counterroll to determine effects of positive acceleration on dynamics of vestibular system of rhesus monkeys
[AMRL-TR-71-59] N72-25040
Effects of alcohol on problem solving tasks and vestibular stimulation
[FAA-AM-72-11] N72-25108

VHF OMNIRANGE NAVIGATION
Requirements for channel splitting to accommodate increased VHF omnirange navigation instrument landing systems, and distance measuring equipment facilities
[PAPER-54-71/SC122-3] N72-25602
Concepts, philosophy, and development of minimum operational characteristics for airborne navigation systems
[DO-149] N72-25603

VIBRATION EFFECTS
Effect of disturbances produced by vibrating ribbon on accelerated laminar boundary layer at low Reynolds numbers
[AD-738335] N72-25321
Vibration measurements on walls of turbojet test facility
[TL-1971-11] N72-25898

VIBRATION MEASUREMENT
Numerical analysis of vibrations and stability of fluid filled shells and gas flowing through shells as viscous incompressible fluid
N72-25907

VIBRATION MODE
Vibration mode and noise spectra of rotating disks including noise reduction of circular saws
[INRS-14/RE-A] N72-25908

VIBRATIONAL SPECTRA
Spectroscopic analysis of vibration spectra and spectral reflectance in AlO3La, AlO3Pr, and AlO3Nd
N72-25685

VIBRATORY LOADS
Variational method for calculating flutter load stability of column
[REPT-105] N72-25882
Eigenvalue curves for rods vibrating under buckling loads
[REPT-107] N72-25883

VIDEO EQUIPMENT
Infrared radiometer and video scan system for remote sensing of root rot disease in Pacific Northwest Douglas fir tree population
[NASA-CR-126719] N72-25029
Developmental model of instrumentation record/reproduce system
N72-25799

VIDICONS
Image dissector camera system for high resolution multispectral imagery
N72-25781

VIKING LANDER SPACECRAFT
Safety management plan for Viking project management project management
N72-25976

VIKING MARS PROGRAM
Safety procedures for manned and unmanned spacecraft
N72-25979

VISCOELASTICITY
Mathematical model of Kelvin-Voigt viscoelastic material and influence of internal damping
[REPT-110] N72-25895

VISCOUNT AIRCRAFT
Ultrasonic inspection of wing spar joints on Viscount aircraft
[TR-7105.512] N72-25461

VISCOUS DAMPING
Galerkin stability analysis on critical loads of polygenic systems using Kelvin model and external damping
[REPT-102] N72-25890

VISCOUS FLOW
Integral method extended to viscous interaction phenomena over continuous range of wall cooling ratio
[IC-AERO-72-03] N72-25311

VISUAL DISCRIMINATION
Use of sunlight as underwater visual direction finder by fishes
N72-25089

VISUAL OBSERVATION
Radar and visual tracking of migratory birds to determine correlation of flight altitude and wind direction on direction of migration
N72-25070

VISUAL PERCEPTION
Function of visual cues in orientation navigation systems of desert ants
N72-25088
Visual evoked response as measure of nitrogen narcosis in divers breathing compressed air from 0 to 250 feet
[AD-737208] N72-25114
Methodology and analysis of visual evoked cortical response as measure of stress in hyperbaric atmospheres of naval environment emphasizing slow flash rates
[AD-737209] N72-25115

VOICE COMMUNICATION
Adaptive narrow band, frequency modulation, voice communication system
N72-25783

VOIDS
Role of hydrogen in formation of massive voids during electron beam welding of titanium and effect of various treatments on hydrogen contamination and elimination
[RM-545] N72-25481

VOLTAGE GENERATORS
Inductive-capacitive loops as load insensitive power converters
[NASA-CASE-ERC-10268] N72-25252

VOLTAGE REGULATORS
Inductive-capacitive loops as load insensitive power converters
[NASA-CASE-ERC-10268] N72-25252
Amplitude limiters and trigger switches with biased diodes for threshold stabilization of alternating voltage
N72-25265

VORTEX GENERATORS
Active and passive systems for detecting and measuring air movements with wingtip vortex generation
[DOT-TSC-FAA-72-13] N72-25313

VORTEX STREETS
Performance tests of acoustic radar equipment to detect vortices formed by low flying aircraft and comparison with conventional sensing methods
[FAA-RD-71-103] N72-25008

VORTICES
Vortex model for calculating airstream at rotor blade of helicopter
[NASA-TT-F-14228] N72-24990
Numerical analysis of finite amplitude waves generated by aircraft trailing vortices to indicate growth of waves on pair of parallel infinite vortices
[AD-737859] N72-25012
Hydrodynamic forces on oscillating cylinder with trailing vortices
N72-25293
Potential flow due to superposition of parallel and vortex flows
[REPT-94] N72-25300

W

WAKES
Effect of cooling on near wake of two dimensional circular cylinder at Mach number 6
N72-25298

WALKING MACHINES
Walking and wheel rotation capabilities of lunar transportation vehicle
N72-25285

WALL FLOW
Integral method extended to viscous interaction phenomena over continuous range of wall cooling ratio
[IC-AERO-72-03] N72-25311
Calculation of annulus wall turbulent boundary layers in axial flow turbines noting flow deflections of blades
[ARC-CP-1196] N72-25314

Heat transfer and laminar incompressible boundary layer on corrugated wall applied to vaporizing combustion chamber
[DLR-FB-71-107] N72-25317
WALLS
Vibration measurements on walls of turbojet test facility
[TL-1971-11] N72-25898
WARNING SYSTEMS
Design of lunar module signal conditioning, caution and warning, and data storage electronics instrumentation subsystems
[NASA-TN-D-6845] N72-25856
WATER MANAGEMENT
Cloud seeding project for increasing water supply in Montana reservoir during five year period
[PB-206948] N72-25401
WATER POLLUTION
Water quality simulation model for well-mixed estuaries and coastal seas
[P-4772-1] N72-25332
Portable tester for monitoring bacterial contamination by adenosine triphosphate light reaction
[NASA-CASE-GSC-10879-1] N72-25413
WAVE ATTENUATION
Measurement of sound attenuation after impact of steel balls on plates
[REPT-7107.521] N72-25625
WAVE DIFFRACTION
Optical diffraction for two-dimensional Fourier amplitude transformation in study of rock fabrics and deformation
[AD-737390] N72-25408
WAVE EQUATIONS
Spherical wave expansion method for synthesizing fields of feed for spherical reflector
N72-25177
WAVE FRONT RECONSTRUCTION
Principles of holography and various methods for production of holograms
N72-25495
WAVE INTERACTION
Mode coupling and wave particle interactions for unstable ion acoustic waves
[NASA-CR-122421] N72-25640
WAVE PROPAGATION
Measurements of harmonic distortion of sinusoidally modulated carrier using envelope and asymmetric sideband detectors
[BBC-1972/13] N72-25176
Feasibility of line-of-sight microwave propagation experiments in analyzing significant meteorological problems
N72-25348
Method to derive statistical characterizations of perturbations imposed upon wave propagating through random medium such as earth atmosphere
N72-25349
Line-of-sight methodology used with microwave propagation in remote atmospheric probing
N72-25350
Atmospheric propagation of sound waves at infrasonic frequencies
N72-25385
Focusing finite-amplitude cylindrical and spherical sound waves in viscous and heat conducting medium
[NASA-CR-112095] N72-25631
ATS 5 millimeter wave propagation measurements for determining atmospheric attenuation of earth-space links
N72-25778
Development of theory for propagation of elastic-plastic waves in truncated conical shells
[AD-737100] N72-25910
WAVEFORMS
Development of family of frequency to amplitude converters for frequency analysis of complex input signal waveforms
[NASA-CASE-MSC-12395] N72-25257
WAVEGUIDES
Waveguide, thin film window and microwave irises
[NASA-CASE-LAR-10513-1] N72-25170
WAVELENGTHS
Development of radiant energy sensor to detect the radiant energy wavelength bands from portions of radiating body
[NASA-CASE-ERC-10174] N72-25409
WEAPON SYSTEMS
Quality control tests on high velocity aircraft rockets and their ignition characteristics
[TL-1971-7] N72-25849
WEAPONS
Components of initial nuclear radiation field from intermediate yield thermonuclear weapon
[ORNL-TM-3396] N72-25660
WEATHER FORECASTING
Application of Doppler radar to meteorological problems
N72-25365
WEATHER MODIFICATION
Equipment and polyhydric chemicals for dispersing fog - Foggy Cloud 4 Project
[TOPR-178-1-121] N72-25154
Cloud seeding project for increasing water supply in Montana reservoir during five year period
[PB-206948] N72-25401
WEATHER STATIONS
Results and future trends of laboratory microbarograph system
[REPT-327] N72-25388
WEIGHT [MASS]
Weight screening method for optimum selection of nickel and cadmium cell plates
N72-25768
WEIGHTLESSNESS
Chemical lasers using low or zero gravity chemical reactions
[NASA-CASE-MSC-10986-2] N72-25489
Design guidelines for habitability and furniture elements for extended periods in zero gravity environment
[NASA-CR-115640] N72-25862
WELD STRENGTH
Metallurgical evaluations of strength in TIG welded metal filled aluminum alloy 2219-T87
[NASA-TM-X-64659] N72-25474
WELDED JOINTS
Ultrasonic inspection of welded joints
[TR-6105.506] N72-25462
Magnetic force welding to form T joints between jet engine parts of dissimilar thickness
[NASA-CASE-LEW-10533-2] N72-25479
WELDED STRUCTURES
Ultrasonic signal counting technique for flaw detection in aluminum welds
[NASA-CR-123649] N72-25464
WELDING
Procedure and apparatus for ultrasonic tests of welded Y joints and Inconel tubes
[TR-7108.533] N72-25458
Bonding tests of weldment filling in forged steel axle
[TR-7103.494] N72-25463
WENTZEL-KRAMER-BRILLOUIN METHOD
Wentzel-Kramer-Brillouin theory of Kelvin-Helmholtz instability in high beta collisionless plasmas
N72-25675
WHALES
Anatomical function of spermaceti organ in sperm whales
[CONTRIB-74] N72-25087
WHEELS
Wheel with omnidirectional movement provided by independent drives for rim elements
[NASA-CASE-MFS-21309-1] N72-25480
WIND [METEOROLOGY]
Applying Doppler techniques to studying atmospheric phenomena
N72-25364
Upper wind data, code, and tables
N72-25586
WIND DIRECTION
Physiological and biological mechanisms responsible for anemomenotactic orientation in beetles and scorpions
N72-25093
WIND EFFECTS
Radar observations of birds migrating in opaque cloud cover to determine effects of wind and meteorological conditions
N72-25073
WIND MEASUREMENT
Remote measurement of winds and atmospheric turbulence by cross-correlation of passive optical signals
N72-25380
Photographic tracking and orbit calculation of cosmos 268 to determine upper atmosphere zonal wind speeds
[RAE-TR-71202] N72-25838
WIND PROFILES
Vertical profiles of wind and temperature by remote acoustical sounding
N72-25386
WIND TUNNEL MODELS
Dampometer for measuring amount of damping in wind tunnel test model
[NASA-CR-123671] N72-25289
Heat transfer tests of delta wing orbiter vehicle model in hypervelocity wind tunnel
[NASA-CR-120024] N72-25863
WIND TUNNEL STABILITY TESTS
Wind tunnel determination of directional and lateral stability and interference effects of cruise engine location on 0.015 scale space shuttle booster
[NASA-CR-120019] N72-25859
WIND TUNNELS
Forced response of laminar boundary layers to free stream oscillations in oscillating flow wind tunnel
[AD-737856] N72-25318
Development and characteristics of laser Doppler velocity instrument to measure velocities of flowing fluids
N72-25505
Development and characteristics of dual scatter laser Doppler velocimeter for flow distribution measurement in wind tunnels, helicopter downwash, and across high lift wing sections
N72-25506
Installation of structures assembly model and wind tunnel systems
[NASA-CR-112056] N72-25712
WIND VELOCITY
Remote probing of optical strength of atmospheric turbulence and of wind velocity at various altitudes by measuring spatial and temporal covariance of scintillation
N72-25356
Airborne sound generated by splitter-type damper air flow, as function of air velocity
[RVO-A70/KM/116] N72-25633
WINDOWS [APERTURES]
Waveguide, thin film window and microwave irises
[NASA-CASE-LAR-10513-1] N72-25170
Development of collapsible transparent observation window for manned spacecraft
[NASA-CR-112085] N72-25852
WINGS
Active and passive systems for detecting and measuring air movements with wingtip vortex generation
[DOT-TSC-FAA-72-13] N72-25313
WINTER
Synoptic meteorological weather charts of Northern Hemisphere for November, 1971
N72-25576
WOOD
Research projects in energy sources, energy development, and exploitation
[ORNL-EIS-72-18-VOL-1] N72-25635
WORK FUNCTIONS
Computer aided two dimensional analysis of silicon metal Schottky gate field effect transistor transport equation
[DISS-4661] N72-25271
WORMS
Organic materials for underwater protection of timber attacked by shipworms
[REPT-498] N72-25549

X

X RAY ASTRONOMY
X ray spectroscopy of Cygnus region
[NASA-TM-X-65903] N72-25723
Electronic systems of multiwire proportional counter to measure extra-solar X ray fluxes during Black Brant 4 flight
[NASA-CR-115509] N72-25743
X RAY SPECTROSCOPY
Interstellar absorption of Crab nebula soft X ray flux and X ray spectrum of Crab pulsar
N72-25734
X RAY TELESCOPES
Computerized simulation of X ray telescope geometrical optics
N72-25780
X RAYS
Bremsstrahlung X rays, optical diagnostics, and microwave calculations
[COO-1695-39] N72-25671
X-24 AIRCRAFT
Pilot safety considerations in design and operation of X-24A lifting body vehicle
N72-25969
XANTHINES
Analysis of nonradiative transitions in Xanthine coloring matter by flash photolysis and spectrofluorometry
N72-25155
XENON LAMPS
Xenon flashlamp driver system for optical laser pumping
[NASA-CASE-ERC-10283] N72-25485

Y

YARNS
Tensile and shear strength of polyester yarns for balloon materials
[NASA-CR-2047] N72-25546
YIELD STRENGTH
Yield criteria for shell surfaces
[TN-1] N72-25891

Z

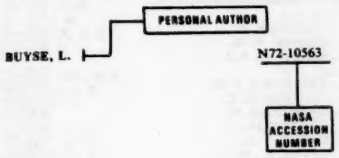
ZEEMAN EFFECT
Near ultraviolet spectra and Zeeman effects of iron and titanium containing corundum crystals
[DISS-4600] N72-25689
ZINC ALLOYS
Creep, tensile and thermal properties, and microstructure of Zn-Al alloys
[BM-RI-7538] N72-25518
ZIRCONIUM COMPOUNDS
Properties of ZrO2, ThO2, and ZrB2 and potential for use in advanced biowaste resistojets
[NASA-CR-112075] N72-25547

Radiation damage in natural zircon caused by alpha particle recoil of parent uranium nucleus [ORO-4049-2] N72-25659

ZONAL HARMONICS
Explicit theory of orbit perturbations due to zonal gravitational harmonics N72-25738

PERSONAL AUTHOR INDEX

TYPICAL PERSONAL AUTHOR INDEX LISTING



Listings in this index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

AARONS, J. N72-25351
ACKERMAN, M. N72-25837
ADAMS, G. D. N72-25605
ADLER, P. N72-25481
ADOLPHS, D. N72-25266
ADOLPHSEN, J. W. N72-25803
AGARKOV, G. B. N72-25107
AGREEN, R. W. N72-25860
AIKIN, A. C. N72-25341
ALAIN, P. N72-25685
ALBRECHT, B. N72-25910
ALDRICH, B. R. N72-25124
ALDRICH, T. B. N72-25112
ALEKSEYEV, G. V. N72-25433
N72-25434
N72-25439
ALLDAY, C. E. N72-25223
ALLEN, J. B. N72-25510
ALLISON, P. R. N72-25968
ALTARELLI, G. N72-25652
AMBROSIANI, J. P. N72-24989
ANDERS, K. P. N72-25441
ANDERSON, J. D. N72-25928
ANDERSON, M. S. N72-25904
ANDERSON, T. O. N72-25210
ANDRIYENKO, A. Y. N72-25870
ANDRYUSHECHKIN, V. I. N72-25516
ANNETT, J. R. N72-25581
ANSTEAD, R. J. N72-25803
APPLETON, M. W. N72-25247
ARIAS, A. N72-25448
ARKHIPOV, R. G. N72-25692
ARKING, A. N72-25827
ARNZEN, H. E. N72-25987
ARONE, R. G. N72-25531
ARORA, B. M. N72-25698
ASCARELLI, P. N72-25537
ASTHEIMER, R. W. N72-25379
ATLAS, D. N72-25363
AUER, G. N72-25676
AUS, H. M. N72-25212
AUSTIN, W. E. N72-25427
AUXIER, J. A. N72-25660
AXFORD, W. I. N72-25722

B

BACHLE, W. H. N72-25021
BAEDECKER, P. A. N72-25754
BAER, D. A. N72-25020
BAKALINSKIY, S. P. N72-25439
BAKER, W. E. N72-25910
BALDIN, V. A. N72-25531
BALDWIN, H. A. N72-25064
BALL, L. W. N72-25973
BALSER, M. N72-25008
BALTIN, R. N72-25650
BANDEEN, W. R. N72-25377
BANKS, H. T. N72-25558
BARAONA, C. R. N72-25023
BARBOSA, M. F. N72-25458
N72-25460
N72-25463
N72-25466
BARNES, A. G. N72-25467
BARNES, B. B. N72-25010
BARRETT, R. V. N72-25406
BASS, A. M. N72-25009
BATES, D. M. N72-25428
BATSCHELET, E. N72-25940
BEALE, H. A. N72-25066
BEARD, C. I. N72-25440
BEARSE, A. W. N72-25350
BEAUCHAMP, R. H. N72-25018
BEAUDET, P. R. N72-25744
BECKER, P. R. N72-25562
BECKER, R. L. N72-25234
BECKLAKE, E. J. N72-25646
N72-25445
BEEHLER, R. E. N72-25446
BEHNKE, R. A. N72-25423
BELKAP, N. J. N72-25328
BELLEVILLE, R. E. N72-25188
BELLROSE, F. C. N72-25062
BELYAKOV, R. V. N72-25076
BELYAYEV, S. Y. N72-25140
BENERJEE, P. N72-25530
BENFATTO, G. N72-25719
BENJAMIN, J. N72-25663
BENN, G. S. L. N72-25606
BENNETT, F. V. N72-25179
BENSON, A. J. N72-25855
N72-25031
BENTLEY, E. L. N72-25042
BERBERT, J. H. N72-25836
BEREMAND, G. B. N72-25830
BERLOFFA, E. N72-25539
BERMAN, V. S. N72-25199
BERNARD, J. N72-25926
BERNATOWICZ, D. T. N72-25656
BEYER, J. H., JR. N72-25022
BHATIA, A. K. N72-25406
BILLINGHAM, J. N72-25647
BILLINGSLEY, J. N72-25129
BILLINGTON, A. E. N72-25797
BILLMAN, K. W. N72-24996
BIRKEMEIER, W. P. N72-25268
BIYBOSUNOV, I. N72-25368
BLACKABY, J. R. N72-25303
BLACKBURN, L. H. N72-25129
BLAUER, J. A. N72-25037
BLEACH, R. D. N72-25168
BLENKINSOP, P. N72-25723
BLEVINS, D. R. N72-25515
BLIMAN, S. N72-25846
BLOCK, A. F. N72-25670
BLOCK, L. B. N72-25773
BLUE, J. W. N72-25395
BLUME, H. C. N72-25645
BLUMRICH, J. F. N72-25258
BOBENRIETH, A. N72-25480
BOCHAREV, V. A. N72-25283
BODNER, S. R. N72-25529
BOEDEKER, L. R. N72-25538
BOGNER, R. S. N72-25488
BONINCONTRO, A. N72-25026
BOOZE, C. F., JR. N72-25637
BOUDREAU, J. E. N72-25104
BOWEN, J. T. N72-25610
BOWER, K. F. N72-25865
BOWERS, H. C. N72-25206
BOYD, A. T. N72-25270
BOYER, E. L. N72-25990
BRALEY, R. C. N72-25678
BRANDT, J. C. N72-25646
BRAUN, W. N72-25811
BRAYTON, D. B. N72-25428
BREAUX, O. P N72-25505
BREGMAN, B. J. N72-25677
BRIDGER, J. M. N72-25281
BRIDGES, J. E. N72-25755
BRONFIN, B. R. N72-25111
BROOK, J. N72-25488
BROWN, B. D. N72-25304
BROWN, J. P. N72-25237
BROWN, R. D. N72-25785
BRUDERER, B. N72-25040
BRUESCHKE, E. E. N72-25072
BUCHANAN, T. D. N72-25111
BUCHHOLZ, R. N72-25863
BUCHSER, B. R. N72-25859
BUECHL, K. N72-25477
BUECHNER, H. K. N72-25504
BULLOCK, T. H. N72-25068
BURCH, D. E. N72-25086
BURCH, J. L. N72-25169
BURGESS, I. A. N72-25832
BURNHAM, D. N72-25958
BURNS, R. K. N72-25313
BURRISS, W. L. N72-24994
BURROWS, R. R. N72-25024
BURSON, Z. G. N72-25809
BUSHMAN, B. M. N72-25660
BUSSER, J. H. N72-25057
BUTLER, D. H. N72-25067
BUXBAUM, O. N72-25256
N72-25002

C

CABIBBO, N. N72-25652
CAHEN, O. N72-25283
CAMETTI, C. N72-25637
CAMPBELL, L. W. N72-25203
CAMPBELL, M. E. N72-25476
CAMPBELL, R. N72-25955
CAMPBELL, T. G. N72-25247
CAMPBELL, W. J. N72-25520
CANNON N72-25948
CANTU, A. M. N72-25839
CAP, F. N72-25676
CARR, A. F., JR. N72-25091
CARREIRA, E. M. N72-25717
CARRIGAN, A. L. N72-25397
CARROLL, P. J. N72-25694
CARTER, N. J. N72-25273
CASTLES, T. R. N72-25101
CATO, J. E. N72-25615
CAUDILL, L. O. N72-25802
CECCON, H. L. N72-25485
CHAHINE, M. T. N72-25375
CHAMBERS, A. B. N72-25129
CHANG, C. J. N72-25843
N72-25844
CHAPPELLE, E. W. N72-25149
N72-25800
CHASE, J. O. N72-25584
CHASON, L. R. N72-25112
CHEN, A. J. N72-25325
CHEN, C. N72-25286
CHEN, W. T. N72-25801
CHEVALERAUD, J. P. N72-25059
CHI, S. W. N72-25915
CHIA, S. N72-25642
CHILES, W. D. N72-25108
CHIN, L. Y. N72-25144
CHIUDERIDRAGO, F. G. N72-25839
CHOUDHURY, A. K. N72-25190
N72-25561
CHOY, L. W. N72-25326
CHRISTOPHER, H. A. N72-25028
CHU, T. N72-25631
CLARK, B. N72-25032
CLARK, C. C. N72-25982
CLARKE, A. P. N72-25195
CLEMESHA, B. R. N72-25359
CLUTE, D. G. N72-25509
COCCA, F. J. N72-25457
COCHRAN, W. W. N72-25065
COCHRANE, J. N72-25969
COCKAYNE, W. N72-25599
COGGINS, G. M. N72-25225
N72-25229
COHEN, J. G. N72-25735
COHEN, M. M. N72-25037
COLCLOUGH, C. N72-25010
COLEMAN, G. T. N72-25310
COLEMAN, P. L. N72-25734
COLLINS, W. A. N72-25595
COLLINS, W. E. N72-25045
COLLIS, R. T. H. N72-25357
CONNOR, C. L. N72-25843

COOK, R. K. N72-25385
COOKE, J. N. C. N72-25054
COOLEY, J. L. N72-25760
N72-25825
N72-25124
COOPER, C. R. N72-25133
COPELAND, R. J. N72-25406
CORWIN, R. F. N72-25847
COSTES, A. N72-25068
COTE, C. E. N72-25777
N72-25208
COUVILLON, L. A., JR. N72-25900
COWPER, G. R. N72-25742
COX, D. N72-25367
COX, D. C. N72-25584
COX, F. W. N72-25167
COX, J. D. N72-25872
COX, K. J. N72-25068
CRAIGHEAD, F. C., JR. N72-25068
CRAIGHEAD, J. J. N72-25731
CREAN, J. P. N72-25037
CROSBIE, R. J. N72-25505
CROSSWY, F. L. N72-25036
CUNNINGHAM, W. F.

D

DALTABUIT, E. N72-25742
DARRAH, J. T., JR. N72-25967
DAS, M. L. N72-25878
DAVIS, C. J. N72-25204
DAVIS, D. P. N72-25450
DAVIS, E. J. N72-25453
DAWN, F. S. N72-25913
DAWSON, J. M. N72-25672
DAY, J. L. N72-25120
DEBRA, D. B. N72-25608
DEBRUIN, M. N72-25661
DECKER, M. T. N72-25372
DEERKOSKI, L. F. N72-25772
N72-25796
DEITZ, P. H. N72-25354
DEKRAMER, C. N72-25766
DELAHAYE, R. P. N72-25056
DEMARTINI, F. N72-25662
DEMOGENES, C. N72-25877
DEMOSS, J. F. N72-25850
DERR, L. J. N72-25260
DESCHAMPS, R. N72-25533
DESHPANDE, S. D. N72-25718
DESIMONE, D. V. N72-25469
DEUTSCH, E. S. N72-25188
DEVEREUX, V. G. N72-25175
DEVINE, E. J. N72-25765
N72-25791
DHOMBRES, J. G. N72-25571
DICKE, R. H. N72-25812
DIETERICH, W. N72-25686
DIETZ, A. N72-25050
N72-25051
DILLE, J. R. N72-25103
DIMARCO, R. J. N72-25875
DITTBENNER, G. R. N72-25443
DOBIE, T. G. N72-25046
DOBROTT, J. R. N72-25429
DOBROWOLNY, M. N72-25675
DONN, W. L. N72-25387
DONNELLY, W. H. N72-25940
N72-25942
DONNINI, J. M. N72-25412
DONOHOE, M. J. N72-25769
DOWNS, W. R. N72-25489
DRIVER, E. T. N72-25984
DUBEE, A. N72-25283
DUHAMEL, A. P. N72-25551
DUNGEY, J. W. N72-25398
DUNLOP, G. L. N72-25514
DUNN, D. N72-25158
DUNN, J. L., JR. N72-25154
DUNN, P. N72-25549
DYER, M. K. N72-25955

E

EASTON, R. A. N72-25172
EAVES, R. H. N72-25863
EBERHARDT, P. N72-25833
EBY, R. J. N72-25871
EDELSTEIN, F. N72-25916
EDWARDS, A. R. N72-25691
EGGERS, D. S. N72-25183
EISENHAUER, C. M. N72-25227
ELIKAN, L. N72-25125
ELLDER, J. N72-25748
ELLINGS, A. C. N72-25708
ELLIOTT, D. G. N72-25292
ELLIOTT, L. N72-25953
N72-25954
ELZIE, J. L. N72-25754
EMLEN, S. T. N72-25074
ENGEL, A. N72-25248
ENGELKEN, E. J. N72-25053
ENRIGHT, J. T. N72-25095
EPSTEIN, J. N72-25844
EVANS, L. C. N72-25259
N72-25726
N72-25727
EVANS, M. L. N72-25548
EVANS, P. R. N72-25071
EVANS, S. H. N72-25117

F

FAIRES, D. E.
FARMAKOVSKIY, S. F.
FARRELL, R.
FEDOR, J. V.
FEDOROVA, N. I.
FEDOSOV, Y. A.
FEJER, A. A.
FERGUSON, D. C.
FERRO FONTAN, C.
FIOCCO, G.
FISCHER, L.
FISK, L. A.
FLANDERS, J. H.
FLECK, R. G.
FLEIG, A. J.
FLORIANI, D.
FONTANELLA, E. L.
FONTHEIM, E. G.
FOOKS, G. F.
FORD, W. F.
FORKOIS, J. L.
FORMAN, M. A.
FOWLER, J. T.
FOX, H. L.
FRANCE, J. T.
FRANK, W.
FREDKIN, E.
FRENCH, R. L.
FRIED, B., D.
FRIED, D. L.
FRIMOUT, D.
FROEHLICH, G.
FROGEL, J. A.
FROHNSDORFF, G.
FUCHS, H. S.
FURR, P. A.
FURUMOTO, H. W.

G

GAFFORD, E. L. N72-25744
GALLAVOTTI, G. N72-25638
GALLER, S. R. N72-25062
GALLOWAY, E. N72-25951
GALPERIN, Y. I. N72-25330
GARCIA CANAL, C. A. N72-25664
GARDNER, A. H. N72-25464
GARDNER, W. R. N72-25743
GARFEIN, A. N72-25680
GARRISON, G. W. N72-25192
GAUSE, R. L. N72-25127
GAUTHREAUX, S. A., JR. N72-25070
GAVIRA, H. E. N72-25262
GEE, T. H. N72-25494
N72-25495
N72-25496
GEHRELS, T. N72-25753
GEISS, J. N72-25725
N72-25833
GELL, C. F. N72-25043
GEORGEFF, M. P. N72-25311
N72-25312
GERA, J., SR. N72-25977
GERZHA, L. A. N72-25432
GIBBINGS, J. C. N72-25315
GIBBS, P. E. N72-25914
GILCHRIST, N. H. C. N72-25176
GILES, G. L. N72-25904
GILL, G. P. N72-25843
N72-25844
GILL, W. L. N72-25913
GILLUM, D. E. N72-25511
GINER, J. N72-25153
GIULIANI, G. P. N72-25662
GLADWELL, G. M. L. N72-25557
N72-25884
N72-25897
GLAHN, H. R. N72-25581
GLOSS, R. J. N72-25301
GODSON, W. L. N72-25378
GOERKE, W. S. N72-25219
GOETHERT, W. H. N72-25505
GOLDBERG, R. A. N72-25341
GOLDEN, D. P. N72-25142
GOLDMAN, S. L. N72-25555
GOLDREICH, P. N72-25823
GOLDSTEIN, R. M. N72-25209
GORMAN, G. F., III N72-25623
GORSLINE, D. S. N72-25402
GORSTEIN, M. N72-25313
N72-25409
GOULD, E. N72-25085
GRAF, H. N72-25833
GRAHAM, K. N72-25969
GRAMS, G. W. N72-25360
GRASSMAN, E. D. N72-25053
GRATZL, H. N72-25676
GRAY, V. H. N72-25911
GRAYBIEL, A. N72-25118
GREEN, J. P., JR. N72-25867
GREEN, M. A. N72-25695
GRIERSON, D. E. N72-25896
GRIESSEIER, H. N72-25575
GRIFFIN, D. R. N72-25073
GRIFONIMANTELLINI, L. A. N72-25839
GRIGORIN-RIABOV, V. V. N72-25196
N72-25197
GRIMM, K. R. N72-25180
GRIMM, M. H. N72-25103
GRISAFFE, S. J. N72-25517
N72-25543
GRISWOLD, J. W. N72-25975
GRITTON, E. C. N72-25332
GROEGLER, N. N72-25833
GRONSTEIN, C. N72-25572
GROSE, V. L. N72-25972
GROSS, K., W. N72-25308
GROSSMAN, K. N72-25827
GRUNDER, H. A. N72-25613
GRUNHOFER, H. J. N72-25055
GRYVNAK, D. A. N72-25169
GUEDRY, F. E., JR. N72-25044
GUEFFIER, G. N72-25056
GUERNET, G. N72-25656
GUTFREUND, K. N72-25179
GWINNER, E. G. N72-25082

H

HABERMANN, W. N72-25226
HABLUTZEL, B. C. N72-25381
HAGEDORN, N. H. N72-25025
HAGLER, M. O. N72-25615
HALBACH, C. R. N72-25547
HALLOCK, J. N. N72-25313
HALPERT, G. N72-25768
HAMBY, C. N72-25601
HAMEL, B. N72-25304
HAMILTON, M. H. N72-25604
HAMILTON, M. L. N72-25024
HAMMER, W. N72-25966
HAMMITT, F. G. N72-25322
HAMMOND, J. K. N72-25597
HANKINS, D. E. N72-25442
HANSEN, H. H. N72-25654
HANSEN, J. S. N72-25889
HANSON, M. P. N72-25544
HARDY, K. R. N72-25362
HARP, J. C. N72-25349
HARPER, D. A., JR. N72-25737
HARRIS, C. S. N72-25038
HARRIS, D. W. N72-25770
HARRIS, J. D. N72-25113
HARSTAD, K. G. N72-25925
HARTENSTEIN, R. N72-25776
HARVEY, G. W. N72-25087
HASBROOK, A. H. N72-25130
HAUKOHL, J. N72-25305
HAUN, C. C. N72-25102
HAURY, V. E. N72-25699
HAYAMA, S. N72-25317
HAYDEN, C. M. N72-25583
HAYES, D. F., SR. N72-25965
HAYS, L. G. N72-25292
HAYWOOD, F. F. N72-25660
HEALY, M. J. N72-25017
HEAP, B. R. N72-25245
HECQ, W. E. N72-25655
HEFLINGER, L. O. N72-25501
N72-25502
HENNIGAN, T. J. N72-25767
HENNINGER, J. H. N72-25769
HENSON, M. M. N72-25084
HENSON, O. W., JR. N72-25084
HEPPNER, J. P. N72-25829
HERMELIN, D. N72-25236
HERRIN, E. N72-25404
HERRNSTEIN, R. J. N72-25081
HERRON, T. N72-25388
HERTZ, H. G. N72-25757
HETZEL, D. S. N72-25143
HEUSER, J. S. N72-25764
HILAL, T. N72-25568
HILBERT, E. E. N72-25172
HILDENBRAND, T. G. N72-25406
HILL, S. J. N72-25732
HILLHOUSE, L. N72-25464
HILTEN, J. S. N72-25487
HINE, R. J. N72-25316
HISADA, M. N72-25094
HIXSON, W. C. N72-25034
HO, M. T. N72-25908
HOADLEY, D. N72-25314
HOARD, E. G. N72-25955
HODGE, D. B. N72-25180
HODGE, D. C. N72-25145

HOEGLUND, B. N72-25750
HOFFLER, G. W. N72-25142
HOFFMAN, T. E. N72-25491
HOGGATT, J. T. N72-25159
HOLKO, K. H. N72-25471
N72-25479
HOLLAND, J. Z. N72-25333
HOLLECK, G. L. N72-25153
HOLLINGS N72-25947
HOLMES, R. N72-25798
HOLT, E. N72-25970
HOLTZE, R. F. N72-25688
HOOD, G. A. N72-25418
HOOKE, F. H. N72-25899
HOOP, J. M. N72-25627
HORLOCK. J. H. N72-25314
HORST, R. L. N72-25214
N72-25215
HOUGHTON, D. E. N72-25010
HOWELL, J. P. N72-25524
HRON, R. L. N72-25249
HSU, L. N72-25161
HUANG, Y. C. N72-25322
HUBER, W. C. N72-25454
HUDDLE, F. P. N72-25934
HUEBNER, G. L., JR. N72-25405
HUNDHAUSEN, A. J. N72-25814
HUNTEN, D. M. N72-25816
HUSEYIN, K. N72-25881
HYLE, C. T. N72-25600

I

INGHAM, J. N72-25315
INGVARSON, P. N72-25749
INNES, D. N72-25780
IPING, P. J. M. N72-25633
IPPOLITO, L. J. N72-25778
ISAY, W. H. N72-24990
ITAMI, M. T. N72-25458
IVAKHNENKO, O. G. N72-25136

J

JACOBS, G. J. N72-25062
JALUFKA, N. W. N72-25649
JELLINEK, J. N72-25285
JELTSCH, R. N72-25565
JENKINS, L. W. N72-25846
JENNINGS, A. E. N72-25108
JESSUP, A. D. N72-25284
JHANSALE, H. R. N72-25892
JILLY, L. F. N72-25711
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JUNKER, A. M. N72-25040
JUSTUS, C. G. N72-25336

K

KAEUFFL, J. K. N72-25302
KAISER, J. A. N72-25795
KALB, H. T. N72-25505
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KANWISHER, J. W. N72-25069
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KEBKALO, V. I. N72-25030
KEETON, W. T. N72-25098
KEISER, G. N72-25629
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KELLEY, J. A. N72-25953
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KELLIHER, W. C. N72-25924
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KESSLER, E. N72-25365
KESTER, J. D. N72-25632
KHALAFALLA, S. E. N72-25519
KHAN, A. Q. N72-25852
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KIEBURTZ, R. B. N72-25370
KIKIN, G. M. N72-25703
KIKUCHI, C. N72-25683
KILCHEVSKII, N. A. N72-25907
KIMBERLIN, J. N72-25754
KING-HELE, D. G. N72-25838
KING, J. I. F. N72-25376
KING, R. N. N72-25028
KING, W. M. N72-25709
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KLOPP, W. D. N72-25523
KNIGHT, E. N72-25942
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KOBRYNSKI, M. N72-25636
KOCH, B. N72-25503
KODIS, R. N72-25313
KOELLE, D. E. N72-25909
KONDRATYEV, K. Y. N72-25582
KOROSTOVTSEVA, T. A. N72-25529
KORTHOVEN, P. J. M. N72-25661
KOSTOV, K. L. N72-25138
KOZAK, B. N72-25425
KRAEHENBUEHL, U. N72-25833
KRAUSE, F. R. N72-25381
KRISTIANSEN, M. N72-25615
KROGVIG, A. N72-25235
KRUMINS, M. V. N72-24995
KRUMPE, P. F. N72-25327
KUBASCHEWSKI, O. N72-25697
KUDIN, I. N. N72-25516
KULYA, V. I. N72-25139
KURIGER, W. L. N72-25490
KURODA, Y. N72-25687
KURTZ, K. H. N72-25689
KURYLO, M. J., III N72-25428
KUSHNER, H. J. N72-25559
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KVITKY, J. N72-25332

L

LACOSTE, R. N72-25552
LAGASSE, J. N72-25847
LAMNECK, J. H., JR. N72-25023
LAMPARD, T. R. G. N72-25607
LANCASTER, M. C. N72-25053
LANDES, H. S. N72-25170
LANDGREN, P. G. N72-25220
LANE, F. L. N72-25522
LANGLEY, R. D. N72-25857
LAPRIE, J. C. N72-25847
LARSON, L. L. N72-25455
LAWRENCE, R. S. N72-25352
LAYLAND, J. W. N72-25207
LEAVITT, R. K. N72-25563
LEDERER, J. N72-25988
LEDERER, P. S. N72-25487
LEDERGERBER, P. G. N72-25567
LEE, D. B. N72-25923
LEE, H. P. N72-25763
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LEENDERTSE, J. J. N72-25332
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LEISTIKOW, S. N72-25505
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LENHART, K. G. N72-25475
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LEONARD, C. D. N72-25225
LEUTERT, G.
LEVINE, J. H.
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LEVINE, S. R.
LEVY, A. V.
LEVY, L. L., JR.
LHERMITTE, R. M.
LIBOVE, C.
LICKLIDER, J. C. R.
LINDAUER, M.
LINDSTROM, E. E.
LINSENMAIR, K. E.
LIPPENS, C.
LISZKA, L.

M

MABEY, D. G.
MACEWEN, J. D.
MACH, K. D.
MACKAY, S.
MACLEOD, N. H.
MADISON, D. M.
MAHAJAN, K. K.
MAHEFKEY, E. T.
MAIANI, L.
MALASKY, W. W.
MALCOLM, R.
MALONE, L. B.
MANDELKORN, J.
MANGUS, J. D.
MANUS, E. A.
MARASIGAN, J. A.
MARGOLIS, J. S.
MARKER, H. E.
MARKOV, G. S.
MARKS, S. L.
MARR, H. E., III
MARRONI, M. A., JR.
MARSH, J. G.
MARSHALL, J. S.
MARSIK, S. J.
MARTIN, H.
MARTIN, M.
MARTIN, P.
MARTIN, W. L.
MARTINELLI, A. P.
MASHKOVICH, V. P.
MASLOVA, Y. N.
MASON, E. A.
MATCHETT, W.
MATSUHISA, I.
MAURY, J. L.
MAX, C. E.
MAXWELL, J. C.
MAY, C. E.
MAYES, P. E.
MAYR, H. G.
MCAULAY, R. J.
MCCARTY, B. J.
MCCLELLAN, R. O.
MCCROSKY, R. E.
MCDONALD, D. L.
MCDOUGAL, A. R.
MCDUFF, J. M.
MCFADDEN, E. B.
MCFARLAND, T. P.
MCINTOSH, R., JR.
MCKAY, C. L.
MCLYMAN, W. T.
MCNEILL, D. A.
MCPHERSON, T. M.
MCWILLIAMS, I. G.
MEADOWS, D. M.
MEISSNER, H.
MELAMED, L.
MENDIA ITURBE, M. D.
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MENDIA, M. D. N72-25833
MENICHELLI, V. J. N72-25492
MENSCH, A. N72-25115
METGES, P. J. N72-25056
MEYER-ERKELENZ, J. D. N72-25052
MIELE, A. N72-25225
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MIERTSCHIN, J. L. N72-25256
MIHALCEA, N. N72-24993
MILLER, A. N72-25106
MILLER, C. O. N72-25974
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MILLER, E. W. N72-25736
MILLER, H. A. N72-25941
MINZNER, R. A. N72-25424
MISTROT, P. N72-25908
MITRA, A. P. N72-25718
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MITTAL, K. K. N72-25331
MOERGELI, M. N72-25833
MOHLER, S. R. N72-25952
MOKELKE, H. N72-25000
MONCHICK, L. N72-25639
MONDT, J. F. N72-25704
MONEY, K. E. N72-25041
MONTGOMERY, A. J. N72-25380
MONTMERLE, T. N72-25657
MOONEY, L. G. N72-25660
MOORE, C. E. N72-25807
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MOORE, R. N72-25858
MOORE, T. J. N72-25471
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MOORE, Z. J. N72-25154
MORAN, P. J. N72-25028
MORGAN, P. J. N72-25415
MORKOVIN, M. V. N72-25318
MORRIS, D. E. N72-25151
MORRIS, J. P. N72-25125
MORRIS, R. S. N72-25971
MORTENSEN, L. O. N72-25411
MOSELEY, P. E. N72-25225
MOSIER, B. N72-25120
MROZ, Z. N72-25894
MUENCH, W. F. N72-25163
MULHOLLAND, J. D. N72-25486
MULLEN, L. O. N72-25447
MULLER, C. N72-25837
MUMMA, G. B. N72-25979
MURPHY, J. P. N72-25758
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N

NAGIB, H. M. N72-25320
NAGLE, R. E. N72-25583
NAGY, A. E. N72-25008
NAKAGAWA, E. I. N72-25016
NAKICH, R. B. N72-25628
NAZAROV, G. V. N72-25528
NEJAT, V. T. N72-25921
NELSON, A. W. N72-25593
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NESTOROV, G. N72-25389
NETZLER, G. P. R. N72-25598
NEUMEIER, L. A. N72-25518
NEWMAN, J. M. N72-25152
NICCUM, R. J. N72-25546
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NICOLAS, M. N72-25669
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NIELSEN, W. C. N72-25246
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NOLA, F. J. N72-25267
NOONAN, B. J. N72-25730
NORDLUND, D. R. N72-25677
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NORRIS, K. S. N72-25087
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NOVIKOV, S. S. N72-25926
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NYELAND, C. N72-25639

O

OBERHOLTZER, J. D. N72-25424
OBRIEN, D. E., III N72-25856
OCONNOR, P. J. N72-25047
OGILVIE, K. N72-25815
OLIVER, R. E. N72-25193
OLIVER, R. L. N72-25019
OLSEN, C. D. N72-25707
OMORI, S. N72-25308
OTT, R. N72-25162
OWEN, T. N72-25817
OWENS, T. W. N72-25168

P

PAGE, R. J. N72-25547
PAILLOUS, A. N72-25554
PANKHURST, R. C. N72-25493
PANTER, W. C. N72-25187
PANZARELLA, P. P. N72-25007
PARIN, V. V. N72-25189
PARISEAU, W. G. N72-25473
PARK, R. J. N72-25324
PARKER, R. L. N72-25506
PARSONS, W. E. N72-25211
PARTUS, F. P. N72-25912
PASCIUTTI, E. R. N72-25253
PATTERSON, M. R. N72-25646
PATTERSON, W. J. N72-25148
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PATTON, D. E. N72-25203
PAULEY, J. D. N72-25123
PAXSON, E. W. N72-25221
PEARCE, L. M. N72-25941
PEELGREN, M. L. N72-25703
PEGDEN, C. D. N72-25853
PEL, D. J. N72-25655
PEMBROOK, J. D. N72-25169
PENDLETON, E. L. N72-25154
PENN, F. W. N72-25584
PERAUDEAU, M. C. N72-25156
PERDRIEL, G. N72-25059
PEREL, J. N72-25710
PERKINS, G. S. N72-25456
PERLMAN, M. N72-25276
PERRY, D. H. N72-24998
PERRY, I. C. N72-25346
PESTOV, Y. N. N72-25431
PETERSON, N. C. N72-25428
PETRASEK, D. W. N72-25539
PETROV, B. N. N72-25870
PEZE, F. N72-25243
PFEIFFER, W. A. N72-25181
PFLEGEL, P. N72-25165
PHILIPP, W. H. N72-25164
N72-25452
PHILLIPS, H. L. N72-25721
PHILLIPS, W. M. N72-25545
PICCIOLO, G. L. N72-25149
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PIERCE, E. T. N72-25383
PIKE, E. W. A. N72-25319
PINCUS, H. J. N72-25408
PINKEL, I. N72-25964
POMPI, R. L. N72-25654
PONOMAREV, V. P. N72-25030
PONZI, U. N72-25918
POORMAN, R. M. N72-25474
POPE, W. C. N72-25963
POPKOVA, L. I. N72-25437
PORT, C. D. N72-25111
PORTMAN, D. J. N72-25353
PORTNOV-SOKOLOV, Y. P. N72-25870
POSMENTIER, E. S. N72-25387
POWELL, A. L. T. N72-25745
N72-25746
POWELL, J. D. N72-25134
POWERS, E. I. N72-25871
POWERS, L. B. N72-25306
PREDMORE, C. R. N72-25741
PREDMORE, R. N72-25789
PROUDIAN, A. P. N72-25008
PRUETT, W. E. N72-25861
PRYOR, P. N72-25116
PYSZ, G. N72-25525

Q

QUAN, M. N72-25858

R

RADCLIFFE, F. A. N72-25036
RAMASWAMY, M. A. N72-25298
RAMEY, R. L. N72-25170
RAMME, F. B. N72-25121
RANIERE, F. D. N72-25418
RAO, P. R. N72-25681
RAO, V. V. P. K. N72-25681
RAPOSA, F. L. N72-25280
RASMUSSEN, P. G. N72-25130
RASOOL, S. I. N72-25810
N72-25822
RASQUIN, J. R. N72-25124
RATERINK, H. J. N72-25264
RAUH, M. N72-25690
RAUMANN, N. A. N72-25794
REAGAN, J. A. N72-25361
RECKSIEDLER, A. L. N72-25213
REDDY, N. M. N72-25290
REDMAN, M. C. N72-24992
REED, D. N72-25601
REEDER, N. R. N72-25241
REES, D. N72-25403
REEVES, H. N72-25725
REICHMAN, J. N72-25532
REINHOLD, P. N72-25002
REISER, M. N72-25271
RELLER, J. O., JR. N72-25290
REPLOGLE, C. R. N72-25040
RIAZANTSEV, I. S. N72-25926
RICARDI, L. J. N72-25177
RICE, A. N72-25016
RICH, E. N72-25413
RICHARD, C. E. N72-25877
RICHARDS, L. O. N72-25211
RICHARDSON, R. W. N72-25122
RICHTER, R. M. N72-25613
RIDGWAY, S. H. N72-25086
RINDNER, W. N72-25679
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RISBECK, J. S. N72-25518
ROBBINS, M. D. N72-25953
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ROENNAENG, B. O. N72-25220
ROGERS, W. F. N72-25903
ROHRBACH, F. N72-25634
ROLFES, M. J. N72-25289
ROMANYUK, V. A. N72-25399
ROMERE, R. N72-25858
ROMERO, M. N72-25553
ROORDA, J. N72-25881
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ROOT, G. L. N72-25451
ROSAMOND, D. L. N72-25738
ROSENER, A. A. N72-25862
ROSSI, G. C. N72-25663
ROTH, H. N72-25679
ROTSHTEYN, A. Y. N72-25433
N72-25434
N72-25437
N72-25439
ROWE, W. S. N72-24992
ROYSTON, C. L., JR. N72-25183
N72-25186
ROZENVASSER, E. N. N72-25574
RUBIN, D. C. N72-25680
RUBIN, L. N72-25721
RUFENACH, C. L. N72-25740
RUITER, G. H. N72-25320
RUMMLER, D. R. N72-25287
RUPPRECHT, F. C. N72-25109
RUSNAK, W. N72-25599
RUSSELL, D. R. N72-25464
RUTHBERG, S. N72-25728
RYAN, P. W. N72-25015
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RYSKULOV, A. N72-25303
RYZHKOV, V. M. N72-25432
N72-25436

S

SABELMAN, E. E. N72-25269
SABOL, A. P. N72-25307
SAGAT, S. N72-25515
SAKAMOTO, A. N72-25462
N72-25463
SAKHAROV, V. K. N72-25641
SAKURAI, K. N72-25826
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SALTER, W. E. N72-25182
SAMUSENKO, A. V. N72-25573
SANDBORN, V. A. N72-25382
SANDSON, M. L. N72-25860
SANSOM, G. F. N72-25549
SANTAMATO, E. N72-25662
SANTARPIA, D. E. N72-25771
SATHER, H. N. N72-25018
SAUCIER, R. T. N72-25407
SAVAGE, A. N72-25747
SAWCZUK, A. N72-25891
SAWKO, P. M. N72-25147
SAWYER, C. D. N72-25610
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SAXTON, J. A. N72-25198
SAYBEL, A. G. N72-25185
SCARBOROUGH, W. E. N72-25978
SCHAEFER, W. N72-25909
SCHAEFFER, D. R. N72-25535
SCHARPF, R. L. N72-25014
SCHATZMAN, E. N72-25821
SCHAUDY, R. N72-25754
SCHAUPP, R. W. N72-25704
SCHELLIN, T. E. N72-25293
SCHERER, H. P. N72-25782

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SCHIMMOELLER, H. N72-25526
SCHMID, P. E. N72-25756
SCHMIDT-KOENIG, K. N72-25062
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SCHMIDT, E. E. N72-25804
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SCHOCH, F. N72-25272
SCHOEN, A. H. N72-25540
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SCHOTLAND, R. M. N72-25358
SCHUBERT, F. H. N72-25134
SCHUSTER, H. N72-25644
SCHWALLER, H. N72-25833
SCHWARZ, F. C. N72-25251
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SCHWERTL, M. N72-25282
SEBRYAKOV, G. G. N72-25869
SECHRIST, C. F., JR. N72-25329
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SENFTLE, F. E. N72-25659
SEWARD, H. H. N72-25409
SHAEFFER, D. L. N72-25178
SHAH, I. D. N72-25519
SHAPIRO, H. N72-25788
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SHELDON, C. S., II N72-25940
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SHIMAZAKI, T. N72-25337
SHOHET, J. L. N72-25671
SHOLLENBERGER, C. A. N72-25296
SHORES, P. W. N72-25187
SHORT, R. A. N72-25547
SHOVE, P. L. N72-25274
SHRAGER, J. J. N72-25426
SIGNORELLI, R. A. N72-25539
SILVERMAN, J. R. N72-25775
SIMMONDS, P. G. N72-25323
SIMMONS, G. L. N72-25227
SIMON, W. N72-25309
SIMPKINS, L. G. N72-25184
SINITSYN, B. I. N72-25641
SITCHIN, A. N72-25594
SKROTSKIY, B. V. N72-25431
SLOUGH, W. N72-25697
SMETANA, F. O. N72-24991
SMIALEK, J. L. N72-25517
SMIGIELSKI, P. N72-25507
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SMOLUCHOWSKI, R. N72-25818
SNEDEKER, R. S. N72-25321
SOKOLOVSKIY, P. I. N72-25531
SOKOLOWSKI, M. N72-25626
SOLEM, R. N72-25007
SOLOMON, W. C. N72-25168
SOLOVYEV, V. S. N72-25436
SOLUKHA, B. V. N72-25107
SOUTHWORTH, R. B. N72-25808
SOUZA, A. F. N72-25589
SPAIN, I. L. N72-25440
SPENCER, J. H. N72-25560
SPENCER, L. V. N72-25227
SPERB, R. P. N72-25569
SPEZIA, E. N72-25034
SPICER, B. M. N72-25666
SPIEGEL, E. A. N72-25813
SPIER, R. A. N72-25127
SRIVASTAVA, Y. N72-25665
STAELIN, D. H. N72-25373
STANEK, B. N72-25570
STARK, K. W. N72-25790
STEIDINGER, P. N72-25072
STEPHENSON, M. L. N72-25862
STERN, D. P. N72-25340
STETTLER, A. N72-25833
STEWART, C. H. N72-25257
STEWART, R. B. N72-25307
STOLLERY, J. L. N72-25310
STRAKER, E. A. N72-25660
STRANGE, W. E. N72-25344
STREHLOW, H. N72-24993
STREIMER, I. N72-25116
STROEV, P. A. N72-25400
STROHBEHN, J. W. N72-25348
STYLES, T. D. N72-25983
SUGA, N. N72-25083
SUGIURA, M. N72-25630
SUKHOMLIN, E. A. N72-25673
SULLIVAN, D. B. N72-25447
SULLIVAN, S. N72-25659
SULLIVAN, T. N72-25313
SUMMEY, D. C. N72-24991
SUPRUNENKO, V. A. N72-25673
SUREAU, A. N72-25643
SUSANS, D. E. N72-25416
SUSTEK, A. J., JR. N72-25295
SY, F. L. N72-25297

T

TAHBILDAR, U. C. N72-25557
N72-25884
TANNER, L. H. N72-25497
TAPIA DE NAVARRO, G. N72-25751
TAPLIN, D. M. R. N72-25512
N72-25513
N72-25514
N72-25515
N72-25681
N72-25905
TAYLOR, A. C. N72-25955
TAYLOR, F. J. N72-25192
TAYLOR, J. T. N72-25922
TAYLOR, R. E. N72-25793
TEAL, J. M. N72-25069
TEKAWA, M. M. N72-25613
TERNAN, J. G. N72-25278
TESSITORE, F. N72-25858
THACKRAY, R. I. N72-25132
THEKAEKARA, M. P. N72-25787
THOMAS, G. R. N72-25596
THOMPSON, G. L. N72-25876
THORPE, A. N. N72-25659
THURAIRAJAH, A. N72-25880
TILLER, N. G. N72-25288
TINSLEY, J. L. N72-25799
TOBIAS, R. A. N72-25260
TOLOK, V. T. N72-25673
TOLSON, B. A. N72-25453
TOLSTOY, I. N72-25388
TOMPKINS, B. G. N72-25841
TOPPER, T. H. N72-25892
TORNEY, F. L. N72-25429
TOUCHSTONE, R. M. N72-25132
TOY, M. S. N72-25152
TRAINOR, J. H. N72-25774
N72-25786
TRAVIS, D. N72-25186
TRENT, R. L. N72-25173
TRINKS, H. N72-25444
TROLINGER, J. D. N72-25498
TSENG, D. L. N72-25683
TSUTSKAREV, B. M. N72-25439
TSYPIN, S. G. N72-25641
TUCKER, W. T. N72-25404
TURNER, D. N72-25085
TURNER, D. P. W. N72-25116
TURNER, G. L., JR. N72-25049
TYAGI, T. R. N72-25331
TYLER, P. E. N72-25035

U

UNNY, T. E. N72-25299
UPATNIEKS, J. N72-25499
N72-25500

V

VALATHUR, M. N72-25910
VALLEY, J. N72-25651
VANCAMPEN, D. H. N72-25901
VANDERZWAAL, N. J. N72-25264
VANRAALTE, T. L. N72-25242
VANWAART, T. L. N72-25919
N72-25920
VANWELZENIS, R. G. N72-25684
VASON, N. G. N72-25508
VASYLYK, P. B. N72-25141
VAUGHAN, O. H. N72-25171
VAVILOV, E. M. N72-25138
VDDRIFT-HOLTSLAG, N. N72-25661
VELENOV, E. M. N72-25508
VELYCHKO, V. G. N72-25139
VENKATARAMAIAH, K. R. N72-25893
VENKITESWARAN, P. K. N72-25905
VERESHCHAGIN, L. F. N72-25692
VERNOT, E. H. N72-25102
VESELY, W. E. N72-25981
VESSOT, R. F. C. N72-25491
VETTE, A. R. N72-25181
VIEWEG, R. R. N72-25465
VINCENT, S. N72-25344
VIOLINI, G. N72-25664
VISCONTI, G. N72-25396
VOLKMER, K. N72-25116
VOLKOV, V. A. N72-25516
VONGUNTEN, H. R. N72-25833
VONPRAGENAU, G. L. N72-25277

W

WAGNER, C. A. N72-25761
WAGNER, G. N72-25077
N72-25165
WAHAB, S. A. N72-25728
WALCOTT, C. N72-25079
WALDEN, H. N72-25759
WALLACE, G. R. N72-25182
WALLRAFF, H. G. N72-25075
WALTER, W. H., III N72-25053
WANG, J. R. N72-25724
WARD, D. H. N72-25976
WARD, T. C. N72-25548
WASHILEWSKI, P. J. N72-25659
WASSON, J. T. N72-25754
WATERMAN, T. H. N72-25089
WEAR, J. F. N72-25029
WEAVER, L. B. N72-25853
WEAVER, R. N72-25...8
WEAVER, W. L. N72-25865
WEBBON, B. W. N72-25133
WEETON, J. W. N72-25539
WEHNER, R. N72-25088
WEISS, B. N72-25521
WEISTROP, D. E. N72-25417
WELCH, W. J. N72-25371
WEST, G. S., JR. N72-25854
WESTIN, H. N72-25392
WESTLEY, F. N72-25160
WESTWATER, E. R. N72-25372
WESTWOOD, H. J. N72-25512
WHANG, Y. C. N72-25720
WHEELER, R. H. N72-25040
WHEELON, A. D. N72-25369
WHITACRE, H. E. N72-25842
WHITBECK, R. F. N72-25128
WHITE, A. R. N72-25842
WHITE, W. H. N72-25879
WHITEHILL, L. P. N72-25624
WICHMANN, B. A. N72-25244
WIEBE, E. R. N72-25619
WIERSMA, D. J. N72-25329
WILBUR-HAM, J. L. N72-25278
WILLIAMS, H. L. N72-25986
WILLIAMS, J. L. N72-25133
WILLIAMS, J. M. N72-25069
WILLIAMS, T. C. N72-25069
WILLIFORD, J. F. N72-25744
WILLNER, K. N72-25254
WILMOTTE, R. M. N72-25962
WILSON, A. H. N72-25193
WILTSCHKO, W. N72-25097
WINTER, R. N72-25906
WINTERBOTTOM, A. N. N72-25838
WINTHER, B. A. N72-24992
WISHNA, S. N72-25601
N72-25783
WITZKE, W. R. N72-25523
WOLF, S. N72-25942
WOLFE, A. N72-25729
WOLTHUIS, R. A. N72-25142
WOO, K. E. N72-25174
WOOD, C., D. N72-25118
WOOD, J. A. N72-25820
WOODFILL, J. R., IV N72-25856
WOODFORD, J. M. D. N72-25550
WOODRUM, A. N72-25336
WOOLEY, B. C. N72-25100
WOOLLAM, J. A. N72-25440
WOOLLEY, R. N72-25747
WOROBEL, R. N72-25005
WRIGHT, D. B. N72-25122
WU, C. K. N72-25125
WU, F. Y. N72-25629
WU, L. N72-25902
WU, T. M. N72-25653
N72-25654
WUEBBLES, D. J. N72-25337
WUERKER, R. F. N72-25501
N72-25502
WYNN-PARRY, C. B. N72-25058
WYNVEEN, R. A. N72-25134

Y

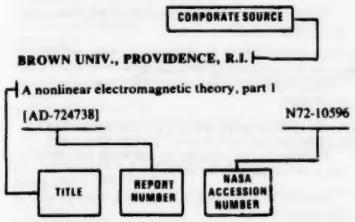
YANG, K. Y. N72-25653
YANG, L. C. N72-25492
YANG, W. N72-25322
YEAGER, R. R. N72-25110
YEE, B. G. W. N72-25464
YEROUCHALMI-SOUSSALINE, F. N72-25157
YIN, S. N72-25001
YOUNG, C. N72-24999
YOUNG, P. R. N72-25924
YUDIN, I. A. N72-25752

Z

ZAFREN, D. H. N72-25957
ZAJEC, E. N72-25613
ZEMAN, J. R. N72-25250
ZHUK, K. D. N72-25137
ZIMMERMAN, E. F. N72-25019
ZIPFEL, J. N72-25052
ZOHAR, S. N72-25222
ZOLOTUKHIN, V. G. N72-25641
ZUK, J. N72-25468
ZYGIELBAUM, A. I. N72-25207

CORPORATE SOURCE INDEX

TYPICAL CORPORATE SOURCE INDEX LISTING



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ADMIRALTY RESEARCH LAB., TEDDINGTON [ENGLAND].
The effect of temperature on drag reduction effectiveness of polyox and of polyacrylamide
[AD-738255] N72-25319
ADMIRALTY SURFACE WEAPONS ESTABLISHMENT, PORTSMOUTH [ENGLAND].
Accelerated life testing of thick film resistors
[AD-738269] N72-25274
ADVANCED ROCKET TECHNOLOGY, IRVINE, CALIF.
Evaluation of zirconia, thoria and zirconium diboride for advanced resistojet use
[NASA-CR-112075] N72-25547
ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS [FRANCE].
The disorientation incident, part 1
[AGARD-CP-95-PT-1] N72-25031
Two specific kinds of disorientation incidents: Jet upset and giant hand
N72-25041
Clinical evaluation and treatment of disorientation in aircrew
N72-25047
Improved and simplified methods for the clinical evaluation of aircrew, part 2
[AGARD-CP-95-PT-2] N72-25048
Nomenclature of terrain colour
[AGARD-AG-159] N72-25346
Guidance and control displays
[AGARD-AR-43] N72-25419
Flight test instrumentation series. Volume 3: The measurement of fuel flow
[AGARDOGRAPH-160-VOL-3] N72-25420
Laser technology in aerodynamic measurements
[AGARD-LS-49] N72-25493
AEROJET LIQUID ROCKET CO., SACRAMENTO, CALIF.
Report, status, mass properties for phase A/B study for a pressure fed engine on a reusable space shuttle booster
[NASA-CR-123638] N72-25700
Design data book phase A/B study for a pressure fed engine on a reusable space shuttle booster
[NASA-CR-123639] N72-25701
AERONAUTICAL CHART AND INFORMATION CENTER, ST. LOUIS, MO.
Observation of a gravimeter with two elastic systems set up on a mobile base
[AD-737110] N72-25399
Estimate of the accuracy of gravity measurements made by L. V. Sorokin on the Black Sea in 1930-1935
[AD-737108] N72-25400
AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., N.J.
Experimental study of transition induced in an accelerated boundary layer at low Reynolds numbers
[AD-738335] N72-25321
AERONAUTICAL RESEARCH LABS., MELBOURNE [AUSTRALIA].
A dynamical theory of flutter
[ARL/SM-332] N72-24996
The lattice dimensions of the AB2 laves phases
[ARL/MET-86] N72-25691
The fatigue life of safe life and fail-safe structures: A state-of-the-art review
[ARL/SM-REPT-334] N72-25899
AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
EC-130E radome compatibility test
[ENEA-71-45] N72-25007
AEROSPACE MEDICAL RESEARCH LABS., WRIGHT-PATTERSON AFB, OHIO.
Effects of acoustic stimuli on the vestibular system
[AMRL-TR-71-58] N72-25038
Analysis of the vestibulo-ocular counterroll reflex in primates
[AMRL-TR-71-59] N72-25040
AIR FORCE ACADEMY, COLO.
Auditory effects on spatial orientation
[AD-737351] N72-25112
AIR FORCE AVIONICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Recollimation of a laser beam
[AD-738288] N72-25509
AIR FORCE CAMBRIDGE RESEARCH LABS., L. G. HANSCOM FIELD, MASS.
The use of satellite beacons for meteorological research
N72-25351
probing the atmosphere with high power, high resolution radars
N72-25362
Towards an optimal inversion method for remote atmospheric sensing
N72-25376
Geophysics and space data bulletin. Volume 8, no. 3: Third quarter 1971
[AD-738327] N72-25397
AIR FORCE ROCKET PROPULSION LAB., EDWARDS AFB, CALIF.
Collisional efficiency in vibrational excitation of HF and DF
[AD-738296] N72-25168
Summary of Air Force exploratory development efforts in high power illumination source
[AD-737832] N72-25678
AIR REGISTRATION BOARD, LONDON [ENGLAND].
Some thoughts about system safety assessment and its current application in aerospace
N72-25968
AIRESEARCH MFG. CO., LOS ANGELES, CALIF.
Preliminary design of an auxiliary power unit for the space shuttle. Volume 2: Component and system configuration screening analysis
[NASA-CR-1994] N72-25024
Hypersonic research engine project. Phase 2: Structures and cooling development
[NASA-CR-112055] N72-25711
Hypersonic research engine project. Phase 2: Structures and cooling development
[NASA-CR-112056] N72-25712
Hypersonic research engine project. Phase 2: Aerothermodynamic integration model development
[NASA-CR-112058] N72-25713
Hypersonic research engine project. Phase 2: Aerothermodynamic integration model development
[NASA-CR-112059] N72-25714
Hypersonic research engine project. Phase 2: Aerothermodynamic integration model development
[NASA-CR-112060] N72-25715
AMERICAN INST. OF BIOLOGICAL SCIENCES, WASHINGTON, D.C.
State of the art: A review
N72-25067
APPLIED MAGNETICS CORP., GOLETA, CALIF.
Processing and plating helical metallic coils
[NASA-CR-122418] N72-25478
ARIZONA UNIV., TUCSON.
DARE 3, a time shared digital simulation system
N72-25212
Comments on bistatic lidar
N72-25361
The distribution of O and early B stars, gas and cosmic dust across the Carina spiral feature
N72-25736
ARMY BOARD FOR AVIATION ACCIDENT RESEARCH, FORT RUCKER, ALA.
The practical application of mishap data in Army aircraft system safety programs
N72-25967
ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Selected geologic literature, Lower Mississippi Valley division area: Index and annotated bibliography, supplement 5
[AD-735775] N72-25407
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER, CHARLOTTESVILLE, VA.
Vibrations of nonlinear systems. The method of integral equations
[AD-738124] N72-25574
ARMY MATERIALS AND MECHANICS RESEARCH CENTER, WATERTOWN, MASS.
Relation between the erosion by solid particles and the physical properties of metals
[AD-738162] N72-25537
ARMY TEST AND EVALUATION COMMAND, ABERDEEN PROVING GROUND, MD.
Gas generating and charging equipment
[AD-738120] N72-25484
ARO, INC., ARNOLD AIR FORCE STATION, TENN.
Aerodynamic holography
N72-25498
Laser metrology
N72-25505
Application of dual scatter laser Doppler velocimeters for wind tunnel measurements
N72-25506
ASIAN INST. OF TECH., BANGKOK [THAILAND].
Some convergence theorems in averaging theory
[TN-34] N72-25571
ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
National Accelerator Laboratory, Batavia, Illinois, environmental statement
[WASH-1505] N72-25291
Major activities in the Atomic Energy Programs, January - December 1971
[TID-25940] N72-25617
ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON [ENGLAND].
A review of the ground data processing data of some of the US/UK satellites
N72-25242
ATOMICS INTERNATIONAL, CANOGA PARK, CALIF.
SNAP reactor programs
[AI-AEC-13017] N72-25618
AUTONETICS, ANAHEIM, CALIF.
Remote probing of the optical strength of atmospheric turbulence and of wind velocity
N72-25356

B

BAGANOFF ASSOCIATES, INC., ST. LOUIS, MO.
Reduction of Skylab 2 ground winds
[NASA-CR-123671] N72-25289
BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Optical propagation in a near-earth environment
N72-25354
BARNES ENGINEERING CO., STAMFORD, CONN.
Remote detection of CAT by infrared radiation
N72-25379
BARRINGER RESEARCH LTD., REXDALE [ONTARIO].
Absorption spectrometer balloon flight and iodine investigations
[NASA-CR-115639] N72-25343
BASEL UNIV. [SWITZERLAND].
Methods of quantitative and qualitative analysis of bird migration with a tracking radar
N72-25072
BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Nontraditional machining of beryllium
[AD-738271] N72-25483

Symposium on Electrodeposited Metals as materials for selected applications
[AD-738272] N72-25536
BATTELLE MEMORIAL INST., RICHLAND, WASH.
Exploratory development and services for preparing and examining ultrathin polished sections of lunar rocks and particulates, part 2
[NASA-CR-115554] N72-25744
BEACH ARMY HOSPITAL, FORT WOLTERS, TEX.
Medical elimination of students undergoing primary flight training
N72-25049
BELL AEROSPACE CO., BUFFALO, N.Y.
Study of automatic flare and decrab guidance and control system for the space shuttle
[NASA-CR-114436] N72-25599
BELL AEROSYSTEMS CO., BUFFALO, N.Y.
Flight control system
[NASA-CASE-MSC-13397-1] N72-25595
BENDIX CORP., ANN ARBOR, MICH.
Oceanographic scanner system design study, volume 1
[NASA-CR-126721] N72-25334
Oceanographic scanner system design study, volume 2
[NASA-CR-126722] N72-25335
The reduction of a "safety catastrophic" potential hazard: A case history
N72-25980
BERN UNIV. [SWITZERLAND].
Cosmic and solar system abundances of deuterium and helium-3
N72-25725
Trapped solar wind noble gases in Apollo 12 lunar fines 12001 and Apollo 11 breccia 10046
N72-25833
BOEING CO., HUNTSVILLE, ALA.
Hydrogen fire blink detector
[NASA-CASE-MFS-15063] N72-25412
BOEING CO., RENTON, WASH.
Prediction of unsteady aerodynamic loadings caused by trailing edge control surface motions in subsonic compressible flow: Analysis and results
[NASA-CR-2003] N72-24992
Study covering calculations and analysis of sonic boom during operational maneuvers. Volume 1: Analysis and computation of maneuver effects
[AD-735296] N72-25011
BOEING CO., SEATTLE, WASH.
Cockpit geometry evaluation. Volume 1: Program description and summary
[AD-738006] N72-25015
Cockpit geometry evaluation. Volume 3: Computer program
[AD-738007] N72-25016
Cockpit geometry evaluation. Volume 4: Mathematical model
[AD-738008] N72-25017
Cockpit geometry evaluation. Volume 5: Validation
[AD-738009] N72-25018
Investigation of the feasibility of developing low permeability polymeric films
[NASA-CR-120892] N72-25159
Alternate space shuttle concepts study. Part 2: Technical summary. Volume 2: Orbiter definition
[NASA-CR-115654] N72-25874
Integrating system safety into the basic systems engineering process
N72-25975
BOEING SCIENTIFIC RESEARCH LABS., SEATTLE, WASH.
Additional line of sight methodology to that presented by John W. Strohbehn in the use of line of sight microwave propagation in remote atmospheric probing
N72-25350
BOLT, BERANEK, AND NEWMAN, INC., CAMBRIDGE, MASS.
Vertical profiles of wind and temperature by remote acoustical sounding
N72-25386
BOSTON UNIV., MASS.
Bio-medical telemetry: Sensing and transmitting biological information from animals to man
[NASA-CR-127047] N72-25191
BRISTOL UNIV. [ENGLAND].
A method of improving aircraft ground performance in slush and wet conditions
[ARC-C[illegible]-1206] N72-25009
BRITISH AIRCRAFT CORP., PRESTON [ENGLAND].
A simulator study of direct lift control
[ARC-CP-1199] N72-25010
BRITISH BROADCASTING CORP., KINGSWOOD [ENGLAND].
Pulse code modulation of video signals: Subjective effect of random digit errors
[BBC-1972/14] N72-25175
The performance of a non-synchronous AM detector designed to remove asymmetric-sideband distortion
[BBC-1972/13] N72-25176
UHF offset generator for laboratory interference tests
[BBC-1972/15] N72-25416
Variation of low-frequency sky-wave field strength with solar activity in Europe
[BBC-1972/12] N72-25731
BROOKHAVEN NATIONAL LAB., UPTON, N.Y.
Rotating fluidized bed reactor for space nuclear propulsion, Annual report: Design studies and experimental results, June, 1970 - June 1971
[NASA-CR-126738] N72-25611
BROWN UNIV., PROVIDENCE, R.I.
Control of functional differential equations with function space boundary conditions
[NASA-CR-126769] N72-25558
Stochastic stability
[CDS-TR-72-2] N72-25559
BUREAU OF MEDICINE AND SURGERY, WASHINGTON, D.C.
Disorientation, fact and fancy
N72-25035
BUREAU OF MINES, BARTLESVILLE, OKLA.
A field survey of emissions from aircraft turbine engines
[BM-RI-7634] N72-25584
BUREAU OF MINES, COLLEGE PARK, MD.
Identification and analyses of copper-base alloys by fluorescent X-ray spectrography
[BM-RI-7635] N72-25520
BUREAU OF MINES, MINNEAPOLIS, MINN.
Kinetics of thermal decomposition of copper[II] sulfate and copper[II] oxysulfate
[BM-RI-7638] N72-25519
BUREAU OF MINES, WASHINGTON, D.C.
Computer simulation of particulate systems
[BM-BULL-658] N72-25228
Gravity flow of powder in a lunar environment. 1: Property determination of simulated lunar soil
[BM-RI-7543] N72-25472
Gravity flow of powder in a lunar environment. 2: Analysis of flow initiation
[BM-RI-7577] N72-25473
Creep and other properties of extruded zinc-30 percent aluminum alloys containing magnesium
[BM-RI-7538] N72-25518

C

CALIFORNIA INST. OF TECH., PASADENA.
Finite amplitude waves on aircraft trailing vortices
[AD-737859] N72-25012
An investigation of a two-dimensional propulsive lifting system
N72-25296
Experimental investigation of the effect of cooling on near wake of circular cylinder at Mach number six
N72-25298
Characteristics of disk and halo populations derived from photographic photometry
N72-25417
Magnetospheric access of solar particles and the configuration of the distant geomagnetic field, volume 1
[NASA-CR-122359] N72-25726
Magnetospheric access of solar particles and the configuration of the distant geomagnetic field, volume 2
[NASA-CR-122360] N72-25727
The lithium isotope ratio in F and G field stars
N72-25735
Infrared spectra of late-type stars
N72-25739
CALIFORNIA UNIV., BERKELEY.
A selective review of ground based passive microwave radiometric probing of the atmosphere
N72-25371
CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Pulsed heavy ion source for the bevatron
[LBL-304] N72-25613
CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
Strain gaging nickel plated uranium
[UCRL-51169] N72-25443
CALIFORNIA UNIV., LOS ANGELES.
Mode coupling and wave particle interactions for unstable ion acoustic waves
[NASA-CR-122421] N72-25640
Trace element studies of rocks and soils from Oceanus Procellarum and Mare Tranquillitatis
[NASA-CR-115570] N72-25754
History of the lunar orbit
N72-25823
CALIFORNIA UNIV., SAN DIEGO.
Neurophysiological findings relevant to echolocation in marine animals
N72-25086
CAMBRIDGE UNIV. [ENGLAND].
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N72-25066
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N72-25286
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N72-25717
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N72-25720
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N72-25730
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N72-25236
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N72-25056
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N72-25059
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[RR-102] N72-25220
A system for automatic time synchronization based on the timing capability of the Loran-C navigational network
[RR-104] N72-25598
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[RR-96] N72-25748
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[REPT-98] N72-25750
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N72-25363
CHRYSLER CORP., NEW ORLEANS, LA.
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[NASA-CR-120033] N72-25858
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[FAA-AM-72-11] N72-25108
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[FAA-AM-72-9] N72-25130
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[FAA-AM-72-10] N72-25131
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[FAA-AM-72-14] N72-25132
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N72-25070
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N72-25382
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N72-25732
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N72-25740
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N72-25805
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N72-25074
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N72-25098
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[DISS-4705] N72-25163
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[DISS-4661] N72-25271
Construction of a superheterodyne X band transmitter and receiver system for ERP and MRR
[DISS-4673] N72-25272
Theoretical and experimental studies on electrostatic filter plates
[DISS-4608] N72-25279
On the stability problem in rotating uneven shafts under torsion
[DISS-4623] N72-25477
The Riemann mapping equation in constructive analysis
[DISS-4707] N72-25565
A convergent iteration procedure for calculating the roots of a polynomial
[DISS-4653] N72-25566
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[DISS-4460] N72-25567
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[DISS-4624] N72-25568
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N72-25372
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N72-25234
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N72-25235
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N72-25237
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N72-25238
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N72-25240
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N72-25241
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[NASA-CR-123649] N72-25464
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[NASA-CR-115664] N72-25143
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[NASA-CASE-MFS-21441-1] N72-25427
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[TID-25901] N72-25616
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[AD-736769] N72-25028
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[NASA-CR-126739] N72-25915
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N72-25972
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[RM-545] N72-25481
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[RM-544] N72-25532
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N72-25978
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N72-25987

H

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N72-25081
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N72-25094
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N72-25369
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N72-25966
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[AD-738135] N72-25145
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N72-25981
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N72-25380
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N72-25065
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[NASA-CASE-NPO-11264] N72-25174

Telecommunications system design for the Mariner Mars 1971 spacecraft
[NASA-CR-126968] N72-25192

Furlable spacecraft antenna development
[NASA-CR-126966] N72-25193

Communications link for computers
[NASA-CASE-NPO-11161] N72-25207

Method and apparatus for frequency-division multiplex communications by digital phase shift of carrier
[NASA-CASE-NPO-11338] N72-25208

Binary coded sequential acquisition ranging system
[NASA-CASE-NPO-11194] N72-25209

MOD 2 sequential function generator for multibit binary sequence
[NASA-CASE-NPO-10636] N72-25210

Counting digital filters
[NASA-CASE-NPO-11821-1] N72-25222

Digital video display system using cathode ray tube
[NASA-CASE-NPO-11342] N72-25248

Inverter oscillator with voltage feedback
[NASA-CASE-NPO-10760] N72-25254

Thermal motor
[NASA-CASE-NPO-11283] N72-25260

Ferrofluidic solenoid
[NASA-CASE-NPO-11738-1] N72-25269

An organization of a digital subsystem for generating spacecraft timing and control signals
[NASA-CR-126971] N72-25276

Two phase flow system with discrete impinging two-phase jets
[NASA-CASE-NPO-11556] N72-25292

Plume backscatter measurements using quartz crystal microbalances in JPL Molsink [molecular sink]
[NASA-CR-126967] N72-25309

Atmospheric sampling devices
[NASA-CASE-NPO-11373] N72-25323

Determination of the temperature profile in an atmosphere from its outgoing radiation
N72-25375

Light sensor
[NASA-CASE-NPO-11311] N72-25414

Quick disconnect coupling
[NASA-CASE-NPO-11202] N72-25450

Coaxial injector for reaction motors
[NASA-CASE-NPO-11095] N72-25455

Ball screw linear actuator
[NASA-CASE-NPO-11222] N72-25456

Short range laser obstacle detector
[NASA-CASE-NPO-11856-1] N72-25490

Initiation of insensitive explosives by laser energy
[NASA-CR-126741] N72-25492

Investigation of gold embrittlement in connector solder joints
[JPL-TM-33-533] N72-25522

Some observations on uranium carbide alloy/tungsten compatibility
[NASA-CR-126869] N72-25545

The least squares process of MEDIA for computing DRVID calibration polynomials
[NASA-CR-126970] N72-25563

Out-of-core evaluations of uranium nitride fueled converters
[NASA-CR-126864] N72-25609

Closed-loop dynamics of in-core thermionic reactor systems
[NASA-CR-126868] N72-25610

Helium refrigerator and method for decontaminating the refrigerator
[NASA-CASE-NPO-10634] N72-25619

Digital servo control of random sound test excitation
[NASA-CASE-NPO-11623-1] N72-25628

A compilation of laboratory spectra
[NASA-CR-126985] N72-25648

Probe measurements of a cesium plasma in a simulated thermionic energy converter
[NASA-CR-126866] N72-25668

Properties of conductive thick-film inks
[NASA-CR-126973] N72-25688

Completely modular Thermionic Reactor Ion Propulsion System [TRIPS]
[NASA-CR-126865] N72-25703

Thermionic reactor electric propulsion system requirements
[NASA-CR-126867] N72-25704

Radar and radio exploration of the planets
N72-25819

Study of advanced techniques for determining the long-term performance of components
[NASA-CR-126720] N72-25845

On dimensional line radiative transfer
[NASA-CR-126965] N72-25925

Experimental tests of relativistic gravitation theories
[NASA-CR-126746] N72-25928

JOHANN-WOLFGANG-GOETHE-UNIVERSITAT, FRANKFURT AM MAIN [WEST GERMANY].
Anemomenotatic orientation in beetles and scorpions
N72-25093

Magnetic effect on dancing bees
N72-25096

The influence of magnetic total intensity and inclination on directions preferred by migrating European robins [Erithacus rubecula]
N72-25097

JOHNS HOPKINS UNIV., BALTIMORE, MD.
Individual recognition between mother and infant bats [Myotis]
N72-25085

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Plant cultivation in space
[JPRS-56129] N72-25106

Cybernetics research reported
[JPRS-56072] N72-25135

Problems of complex system modeling and applied mathematical statistics
N72-25136

Problems of axiomatic approach to the construction of the theory of logic-dynamic control systems, part 2
N72-25137

Automata behavior in random media with restricted length of input words
N72-25138

On one method of information output in speech form from computers
N72-25139

A hypothetical heart-lungs model
N72-25140

On the choice of an index function for long-term prognostication of the development of science
N72-25141

Radar theory and practice
[JPRS-56143] N72-25185

Biological telemetry
[JPRS-55354] N72-25189

Geophysical equipment
[JPRS-56099] N72-25430

A quantum fluxmeter for measuring weak and very weak magnetic fields with a superconducting quantum interference sensor
N72-25431

Spin precession excitation by means of phase modulation of pumping light
N72-25432

Continuous automatic measurement of geomagnetic field components
N72-25433

Adjustment of quantum magnetometers when measuring geomagnetic components
N72-25434

Geographical limitations of an approximate compensation of airplane magnetic fields
N72-25435

Quantum magnetometer without orientation skip zones
N72-25436

Errors in a device for measuring declination and inclination angles
N72-25437

Design principles of optically pumped magnetometers for measuring very weak magnetic fields
N72-25438

Absolute marine component magnetometer
N72-25439

Cold resistance of steel and steel structures
[JPRS-56070] N72-25527

Analysis of the tendency to brittle fracture of weld joints of medium-alloy steels prepared by the electroslag process
N72-25528

Influence of chromium, manganese, and conditions of heat treatment on the cold-shortness of type 30kh2GN2 steel
N72-25529

Influence of cracks on the strength of high-strength sheet structural materials
N72-25530

Tendency of low-alloy steels to cold-shortness for metallic structures
N72-25531

Production of metallic hydrogen
[JPRS-56130] N72-25692

Soviet-bloc research in geophysics, astronomy, and space, no. 276
[JPRS-55985] N72-25824

Soviet bloc research in geophysics, astronomy, and space, no. 277
[JPRS-56154] N72-25834

Spacecraft control systems
[JPRS-56134] N72-25868

Method of analyzing random parametric effects in spacecraft control systems
N72-25869

Evaluating the precision of spacecraft control systems
N72-25870

Translations on eastern Europe: Scientific affairs, no. 246
[JPRS-56106] N72-25959

K

KANSAS UNIV., LAWRENCE.
A pulse modulated biotelemetry system for monitoring heart rate and body temperature in free ranging vertebrates
N72-25123

Design of a representative liquid fuel launch vehicle model to demonstrate the POGO phenomenon
N72-25841

KENTUCKY UNIV., LEXINGTON.
Group separation techniques for the determination of noble metals
N72-25511
KERNFORSCHUNGSZENTRUM, KARLSRUHE [WEST GERMANY].
Investigations of the corrosion behavior of austenitic CrNi steels and nickel alloys in superheated steam
[EURFNR-954] N72-25534
Simplified theory for residual field generated by superconducting dipoles and quadrupoles with unsaturated iron shields
[KFK-EXT-3/71-10] N72-25695
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N72-25390
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N72-25391
On the origin of the infrasound background at 1.9 Hz
[KGO-724] N72-25392
Detection of 2 Hz infrasound from underground nuclear explosions
[KGO-722] N72-25393
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N72-25394
KITT PEAK NATIONAL OBSERVATORY, TUCSON, ARIZ.
Lower atmospheres of the planets
N72-25816

L

LABORATOIRE CENTRAL DE RECHERCHES THOMSON, ORSAY [FRANCE].
Design of printed circuits in conversational mode using graphic display devices
[FP/LP-DR5-1.501/71] N72-25243
Study of a series of electronic and ionic techniques for the design of high resolution active and passive devices
N72-25283
LABORATOIRE D'AUTOMATIQUE ET DE SES APPLICATIONS SPATIALES, TOULOUSE [FRANCE].
Synthesis of studies on the satellite stabilization by ion thrusters
[PUBL-893] N72-25847
LABORATORIO DE ACUSTICA E SONICA, SAO PAULO [BRAZIL].
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[REPT-7105.510] N72-25449
Ultrasonic inspection of weldments and thickness measurement for corrosion control in Inconel tubes in chemical plant
[TR-7108.533] N72-25458
Ultrasonic inspection of odd shape, large size steel casting parts
[TR-7202.568] N72-25460
Ultrasonic inspection of viscount aircrafters joints and lugs
[TR-7105.512] N72-25461
Ultrasonic inspection of weldments and structure components of large size derrick crane
[TR-6105.506] N72-25462
Ultrasonic testing of the bonding in weldment filling in Pegson model 36-B forged steel axle
[TR-7103.494] N72-25463
Ultrasonic inspection of cast SAE-65 brass
[REPT-7110.541] N72-25466
Ultrasonic inspection of cast bronze bars
[REPT-7009.453] N72-25467
Noise levels and octave band analysis of the noise existing in Companhia Vidraria Santa Marina, with conclusions on insalubrity produced by noise pollution
[TR-7201.561] N72-25620
Sound level measurements, octave band analysis of noise in objetivo's installations and in complaining neighbours and suggested solution for the problem
[TR-7111.549] N72-25621
Sound level measurements, octave band analysis of noise produced by a large size Diesel engine, with comments and critiques of the actual Brazilian legislation
[TR-7202.564] N72-25622
Attenuation of sound radiation from plates through resilient bonded material
[REPT-7107.521] N72-25625
LABORATORIUM FUR BETRIEBSFESTIGKEIT, DARMSTADT [WEST GERMANY].
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[TB-88] N72-25002
LAMONT GEOLOGICAL OBSERVATORY, PALISADES, N.Y.
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[REPT-1245] N72-25387
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N72-25934
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N72-25940
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N72-25941
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N72-25942
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N72-25957
LIFE SYSTEMS, INC., CLEVELAND, OHIO.
One-man, self-contained CO2 concentrating system
[NASA-CR-114426] N72-25134
LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
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[AD-738297] N72-25200
A theory for optimal MTI digital signal processing. Part 1: Receiver synthesis
[AD-738298] N72-25201
LITTON SYSTEMS, INC., BEVERLY HILLS, CALIF.
Integrating a multifaceted system safety program for a large complex system
N72-25985
LIVERPOOL UNIV. [ENGLAND].
Flow in a supersonic jet expanding from a convergent nozzle
[ARC-CP-1197] N72-25315
LOCKHEED ELECTRONICS CO., HOUSTON, TEX.
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[NASA-CR-115509] N72-25743
LOCKHEED MISSILES AND SPACE CO., HUNTSVILLE, ALA.
Orifice in-flow efficiency tests. Volume 1: Test results. Volume 2: Application to shuttle venting during entry
[NASA-CR-61383] N72-25305
Load relief and gust alleviation control study
[NASA-CR-123646] N72-25465
Study of aerodynamic surface control of space shuttle boost and reentry, volume 1
[NASA-CR-123644] N72-25843
Study of aerodynamic surface control of space shuttle boost and reentry, volume 2
[NASA-CR-123645] N72-25844
LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
On the hydrolocation capability of dolphins
N72-25107
Accuracy and resolution in determining angular target coordinates
N72-25196
Multichannel radar stations
N72-25197
Exponential model of the ionospheric D region
N72-25389
On utilization of the integral relations method to construct mesh schemes in the Poisson equation case
N72-25573
Vibrations and stability of shell fluid systems and the gas flowing through them
N72-25907
Analysis of a nonstationary combustion mode of a condensed system
N72-25926
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[PB-206950] N72-25510
LOGICON, INC., SAN PEDRO, CALIF.
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[AD-735619] N72-25246
LOS ALAMOS SCIENTIFIC LAB., N.MEX.
Factors affecting the design of albedo-neutron dosimeters containing lithium fluoride thermoluminescent dosimeters
[LA-4832] N72-25442
Collective interactions and electrical conductivity of a plasma in strong electrical fields
[LA-TR-71-79] N72-25673
Dynamics of the outer solar atmosphere
N72-25814
LOVELACE FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH, ALBUQUERQUE, N.MEX.
Fission product inhalation program
[LF-44] N72-25109

M

M&S COMPUTING, INC., HUNTSVILLE, ALA.
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[NASA-CR-123559] N72-25216
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[NASA-CR-126668] N72-25217
MAN FACTORS, INC., SAN DIEGO, CALIF.
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[AD-737376] N72-25116
MANCHESTER UNIV. [ENGLAND].
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[ARC-CP-1201] N72-25316
MARCONI SPACE AND DEFENCE SYSTEMS, LTD., FRIMLEY [ENGLAND].
A preliminary design study for a multispectral IR line scanner for use on a research and applications module, volume 1
[REPT-779/72/1-VOL-1] N72-25445
A preliminary design study for a multispectral IR line scanner for use on a research and applications module, Volume 2
[REPT-779/72/1-VOL-2-SUMM] N72-25446
MARINE MINERALS TECHNOLOGY CENTER, TIBURON, CALIF.
Geologic prediction developing tools and techniques for the geophysical identification and classification of sea floor sediments
[AD-737282] N72-25406
MARTIN MARIETTA CORP., BALTIMORE, MD.
Pilot safety for the X-24A lifting body vehicle
N72-25969
MARTIN MARIETTA CORP., DENVER, COLO.
Linear modulator
[NASA-CR-123580] N72-25275
Derivation of a tangent function using an integrated circuit four quadrant multiplier
[NASA-CASE-MSC-13907-1] N72-25281
Neutral buoyancy testing of architectural and environmental concepts of space vehicle design
[NASA-CR-115640] N72-25862
System safety in manned versus unmanned programs
N72-25979
MARYLAND UNIV., COLLEGE PARK.
Texture descriptors using neighborhood information
[TR-184] N72-25188
A lunar transportation vehicle, volumes 1 and 2
N72-25285
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
University role in astronaut life support systems: Space power supply systems
[NASA-CR-2061] N72-25144
Project MAC
[NASA-CR-122427] N72-25224
Laser radar measurements of the aerosol content of the atmosphere
N72-25360
Passive remote sensing at microwave wavelength
N72-25373
The use of high frequency infrared radiometry for remote atmospheric probing with high vertical resolution
N72-25374
Guidance system operations plan for manned CM earth orbital missions using program Skylark 1. Section 2: Data links
[NASA-CR-115663] N72-25604
General physics, plasma dynamics, and communication engineering
[AD-737814] N72-25840
MASSACHUSETTS UNIV., AMHERST.
Finite difference methods for nonlinear dynamic shell analysis
N72-25878
MAX-PLANCK-INSTITUT FUER PLASMAPHYSIK, MUNICH [WEST GERMANY].
Laser - A light source for high speed photography
N72-25504
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An approach toward an analysis of the pattern recognition involved in the stellar orientation of birds
N72-25075
Endogenous timing factors in bird migration
N72-25082
MCDONNELL-DOUGLAS CO., SANTA MONICA, CALIF.
Polymers of perfluorobutadiene and method of manufacture
[NASA-CASE-NPO-10863-2] N72-25152
MCGILL UNIV., MONTREAL [QUEBEC].
Comments on high power high resolution radars
N72-25366
MELBOURNE UNIV., PARKVILLE [AUSTRALIA].
Photoneutron and photoproton spectra
[AD-738005] N72-25666
MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., OTTOBRUNN [WEST GERMANY].
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[ESRO-CR[P]-79] N72-25909

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N72-25378

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[NASA-CR-126743] N72-25921

MICHIGAN UNIV., ANN ARBOR.
Mathematical modelling of normal impact between a finite cylindrical liquid jet and non-slip flat rigid surface
[PB-206912] N72-25322
Local isotropy and refractive index fluctuations in the surface layer of the atmosphere
N72-25353
Experimental holography
N72-25499
Characteristics of dielectric holograms
N72-25500
Niobium hyperfine structure in crystal calcium tungstate
[NASA-CR-126751] N72-25683

MICROPHASE CORP., COS COB, CONN.
MIL SAT COM phased-array control
[AD-738303] N72-25202

MIDWEST RESEARCH INST., KANSAS CITY, MO.
Biomedical applications of aerospace technology
[NASA-CR-126773] N72-25101
Solid lubricants: A survey
[NASA-SP-5059[01]] N72-25476

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[MLM-1864] N72-25535

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[NASA-TN-D-6833] N72-24994
Temperature controller for a fluid cooled garment
[NASA-CASE-ARC-10599-1] N72-25129
Polymeric vehicles as carriers for sulfonic acid salt of nitrosubstituted aromatic amines
[NASA-CASE-ARC-10325] N72-25147
Infrared tunable laser
[NASA-CASE-ARC-10463-1] N72-25268
Analysis of the flow in a 1-MJ electric-arc shock tunnel
[NASA-TN-D-6865] N72-25290

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. ELECTRONICS RESEARCH CENTER, CAMBRIDGE, MASS.
Parasitic suppressing circuit
[NASA-CASE-ERC-10403-1] N72-25280
Space applications instrumentation systems
[NASA-TM-X-2066] N72-25424

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.
Synchronous orbit battery cycler
[NASA-CASE-GSC-11211-1] N72-25020
Flavin coenzyme assay
[NASA-CASE-GSC-10565-1] N72-25149
Location identification system
[NASA-CASE-ERC-10324] N72-25173
STDN network operations procedure for Apollo range instrumentation aircraft, revision 1
[NASA-TM-X-68825] N72-25181
Performance of convolution coding concatenated with MFSK modulation in a Gaussian channel
[NASA-TM-X-65905] N72-25190
A dc to ac to dc converter having transistor synchronous rectifiers
[NASA-CASE-GSC-11126-1] N72-25253
Tungsten contacts on silicon substrates
[NASA-CASE-GSC-10695-1] N72-25259
Effect of modified thermal conductivity on the temperature distribution in the protonosphere
[NASA-TM-X-65900] N72-25339
Unipolar induction in the magnetosphere
[NASA-TM-X-65893] N72-25340
Metallic ions in the equatorial ionosphere
[NASA-TM-X-65891] N72-25341
Interstellar formaldehyde and silicon monoxide in ultra-dense clouds
[NASA-TM-X-65897] N72-25342
A detailed gravimetric geoid from North America to Eurasia
[NASA-TM-X-65884] N72-25344
Experimental approaches to remote atmospheric probing in the infrared from satellites
N72-25377
Bacterial contamination monitor
[NASA-CASE-GSC-10879-1] N72-25413
Large Space Telescope [LST] preliminary analysis and design report, revision A
[NASA-TM-X-68824] N72-25422
Honeycomb panels formed of minimal surface periodic tubule layers
[NASA-CASE-ERC-10364] N72-25540
Honeycomb core structures of minimal surface tubule sections
[NASA-CASE-ERC-10363] N72-25541
A contribution to the controllability of time-lag systems
[NASA-TM-X-65888] N72-25561
Generation of the invariant coefficients of the characteristic polynomial for an nxn matrix
[NASA-TM-X-65885] N72-25562
NASA balloon: Aircraft ranging, data and voice experiment
[NASA-TM-X-65906] N72-25601
The ring current
[NASA-TM-X-65904] N72-25630
D autoionization states of He and ionic H
[NASA-TM-X-65898] N72-25647
Gunn-type solid state devices
[NASA-CASE-XER-07895] N72-25679
Solar modulation of galactic cosmic rays. 3: Implications of the Compton-Getting coefficient
[NASA-TM-X-65901] N72-25722
A study of 2-20 KeV X-rays from the Cygnus region
[NASA-TM-X-65903] N72-25723
The coronal transport of the flare associated scatter free electrons
[NASA-TM-X-65887] N72-25724
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Radio wave propagation experiments to probe the ionosphere
N72-25756
Comparison of satellite theories
N72-25757
An analysis of the expected eccentricity perturbations for the second Radio Astronomy Explorer [RAE B]
N72-25758
Dynamical in-orbit behavior of the Radio Astronomy Explorer satellite
N72-25759
Future techniques for tracking of synchronous satellites
N72-25760
The geopotential at synchronous-orbit altitudes
N72-25761
In-orbit flexible spacecraft dynamics program
N72-25762
Structural-Thermal-Optical Program [STOP]
N72-25763
Two-dimensional finite-element temperature variance analysis
N72-25764
A rotary actuator for space missions
N72-25765
Hybrid circuit modules for motor commutation and control
N72-25766
Automatically activated, 300 ampere-hour silver-zinc cell
N72-25767
Screening and selection of nickel and cadmium cell plates to improve uniformity
N72-25768
The degradation of alzak by short wavelength ultraviolet radiation
N72-25769
Spacecraft radiation analysis
N72-25770
A 10, 6-micrometer laser receiver RF subsystem
N72-25771
Ku-band high gain antenna
N72-25772
Discrete component S-band power amplifier
N72-25773
Flight data systems using LSI P-channel MOSFETS
N72-25774
Telemetry remote modules
N72-25775
An On Board Processor [OBP] for OAO C
N72-25776
The Nimbus 4 IRLS meteorological experiment
N72-25777
Millimeter wave propagation measurements using the ATS 5 satellite
N72-25778
Glancing incidence telescopes for space astronomy
N72-25779
A computer program to evaluate optical systems
N72-25780
Multispectral image dissector camera system
N72-25781
Precision digital solar aspect sensor
N72-25782
An adaptive narrow band frequency modulation voice communication system
N72-25783
Computer-aided CO2 laser cavity-length selection for reduced line competition
N72-25784
Results of FM-TV threshold reduction investigation for the ATS F trust experiment
N72-25785
Radiation damage effects on solid state detectors
N72-25786
Revised standards for the solar constant and the solar spectrum
N72-25787
A computer program to automate residual gas analysis
N72-25788
Experimental thermal mechanics of deployable boom structures
N72-25789
Design and development of a Micropound Extended Range Thrust Stand [MERTS]
N72-25790
Ultra-precise attitude test facility for flight spacecraft
N72-25791
Improved laser ranging accuracy through dynamic threshold compensation
N72-25792
STADAN antenna gain calibration using radio stars
N72-25793
Computer controlled antenna system
N72-25794
Dichroic subreflector for Rosman 2
N72-25795
Signal coherence studies in multiaperture arrays
N72-25796
The NAS-PAK logic system
N72-25797
Simulation of mass storage systems operating in a large data processing facility
N72-25798
Feasibility model of a video instrumentation record/reproduce system
N72-25799
Automated detection of bacteria in urine
N72-25800
The heart sound preprocessor
N72-25801
Long range laser traversing system
N72-25802
Using the scanning electron microscope on the production line to assure quality semiconductors
N72-25803
Ultraprecision tool positioner
N72-25804
Physics of the solar system
[NASA-SP-300] N72-25810
Introduction to solar physics
N72-25811
The interplanetary plasma
N72-25815
Evolution of planetary atmospheres
N72-25822
Orbit selection considerations for earth observatory satellites
[NASA-TM-X-65907] N72-25825
Stability of rotating magnetic stars and planets as Jupiter and the origin of convective motion
[NASA-TM-X-65908] N72-25826
The influence of line shape and band structure on temperatures in planetary atmospheres
[NASA-TM-X-6509] N72-25827
Data acquisition and processing history for the Explorer 33 [AIMP-D] satellite
[NASA-TM-X-65894] N72-25828
Electric fields in the magnetosphere
[NASA-TM-X-65895] N72-25829
Short arc optical survey techniques
[NASA-TM-X-65896] N72-25830
The effect of the Coriolis force on the stability of rotating magnetic stars
[NASA-TM-X-65899] N72-25831
Precipitation of low energy electrons at high latitudes: Effects of substorms, interplanetary magnetic field and dipole tilt angle
[NASA-TM-X-65902] N72-25832
GSFC orbit computations for ISAGEX operations
[NASA-TM-X-65886] N72-25860
UK-4 prototype spacecraft magnetic tests
[NASA-TM-X-65890] N72-25861
A thermal control system for a spacecraft modular housing
[NASA-CASE-GSC-11018-1] N72-25871

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. JOHN F. KENNEDY SPACE CENTER, COCOA BEACH, FLA.
Television multiplexing system
[NASA-CASE-KSC-10634-1] N72-25184
Buffered analog converter
[NASA-CASE-KSC-10397] N72-25206

System for automatically and manually testing lines for determining if information can be accurately transmitted thereon
[NASA-CASE-KSC-10385] N72-25211
Lamp modulator
[NASA-CASE-KSC-10565] N72-25250
Cable stabilizer for open shaft cable operated elevators
[NASA-CASE-KSC-10513] N72-25453

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.

Omnidirectional slot antenna for mounting on cylindrical space vehicle
[NASA-CASE-LAR-10163-1] N72-25247
Hall effect transducer
[NASA-CASE-LAR-10620-1] N72-25255
Radio frequency filter device
[NASA-CASE-XLA-02609] N72-25256
Parametric amplifiers with idler circuit feedback
[NASA-CASE-LAR-10253-1] N72-25258
Variable angle tube holder
[NASA-CASE-LAR-10507-1] N72-25284
Low mass truss structure
[NASA-CASE-LAR-10546-1] N72-25287
Apparatus and method for generating large mass flow of high temperature air at hypersonic speeds
[NASA-CASE-LAR-10612-1] N72-25307
Thermomechanical and thermochemical behavior of a hafnium-20 percent tantalum alloy
[NASA-TM-X-68339] N72-25524
An investigation of satellites to the resonance lines in some hydrogen-like ions
[NASA-TM-X-68338] N72-25649
Entry trajectory, entry environment, and analysis of spacecraft motion for the RAM C-3 flight experiment
[NASA-TM-X-2562] N72-25865
Effects of eccentricities and lateral pressure on the design of stiffened compression panels
[NASA-TN-D-6784] N72-25904
Investigation of phase-change coatings for variable thermal control of spacecraft
[NASA-TN-D-6756] N72-25924
The Viking project safety program N72-25976

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Cost study of solar cell space power systems
[NASA-TM-X-68054] N72-25022
Relationship of dislocation density of silicon to solar cell current loss at low temperature
[NASA-TM-X-68055] N72-25023
Modification of a fuel-cell engine for control by a digital computer
[NASA-TM-X-2575] N72-25025
Electrically conductive fluorocarbon polymer
[NASA-CASE-XLE-6774-2] N72-25150
New methods for preparing n, n-dialkyltrifluoroacetamides
[NASA-TN-D-6836] N72-25161
Production of pure metals
[NASA-CASE-LEW-10906-1] N72-25164
Analog Signal to Discrete Time Interval Converter [ASDTIC]
[NASA-CASE-ERC-10048] N72-25251
Controllable load insensitive power converters
[NASA-CASE-ERC-10268] N72-25252
Angular velocity and acceleration measuring apparatus
[NASA-CASE-ERC-10292] N72-25410
Hall effect magnetometer
[NASA-CASE-LEW-11632-1] N72-25440
Electrical insulating layer process
[NASA-CASE-LEW-10489-1] N72-25447
Method for producing dispersion strengthened alloys by converting metal to a halide, comminuting, reducing the metal halide to the metal and sintering
[NASA-CASE-LEW-10450-1] N72-25448
Selective nickel deposition
[NASA-CASE-LEW-10965-1] N72-25452
Quasi-one-dimensional compressible flow across face seals and narrow slots. 1: Analysis
[NASA-TN-D-6668] N72-25468
Diffusion welding in air
[NASA-CASE-LEW-11387-1] N72-25471
Apparatus for welding blades to rotors
[NASA-CASE-LEW-10533-2] N72-25479
Aluminized nickel coatings for nickel-base superalloys
[NASA-CASE-LEW-11348-1] N72-25517
Mechanical properties of electron-beam-melted molybdenum and dilute molybdenum-rhenium alloys
[NASA-TM-X-2576] N72-25523
Method of making fiber composites
[NASA-CASE-LEW-10424-2-2] N72-25539
Exploration of alloy surface and slurry modification to improve oxidation life of fused silicide coated niobium alloys
[NASA-TM-X-68052] N72-25543
Effect of temperature on the tensile and creep characteristics of PRD49 fiber/epoxy composites
[NASA-TM-X-68053] N72-25544
Production of I-123
[NASA-CASE-LEW-11390-1] N72-25645
Short-range correlations in carbon-12, oxygen-16, and neon-20: Intrinsic properties
[NASA-TN-D-6834] N72-25646
Electricity measurement devices employing liquid crystalline materials
[NASA-CASE-ERC-10275] N72-25680
Ablative system
[NASA-CASE-LEW-10359] N72-25911
Data requirements analysis in support of system safety N72-25964

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Apollo experience report: Processing of lunar samples in a sterile nitrogen atmosphere
[NASA-TN-D-6858] N72-25099
Apollo experience report: Protection of life and health
[NASA-TN-D-6856] N72-25100
Postflight analysis of the EVCS-LM communications link for the Apollo 15 mission
[NASA-TM-X-68426] N72-25183
Apollo experience report: Communications system flight evaluation and verification
[NASA-TN-D-6852] N72-25186
Apollo experience report: Very high frequency ranging system
[NASA-TN-D-6851] N72-25187
Apollo experience report: Real-time auxiliary computing facility development
[NASA-TN-D-6855] N72-25223
Family of frequency to amplitude converters
[NASA-CASE-MSC-12395] N72-25257
Foldable construction block
[NASA-CASE-MSC-12233-1] N72-25454
Method and apparatus for detecting surface ions on silicon diodes and transistors
[NASA-CASE-ERC-10325] N72-25457
Apollo experience report: Certification test program
[NASA-TN-D-6857] N72-25475
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[NASA-CASE-MSC-10986-2] N72-25489
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[NASA-TN-D-6853] N72-25600
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[NASA-CASE-MSC-12372-1] N72-25842
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Apollo 15 mission main parachute failure
[NASA-TM-X-68350] N72-25848
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[NASA-TM-X-68322] N72-25850
Apollo experience report: Mission planning for lunar module descent and ascent
[NASA-TN-D-6846] N72-25855
Apollo experience report: Lunar module instrumentation subsystem
[NASA-TN-D-6845] N72-25856
Apollo experience report: The docking system
[NASA-TN-D-6854] N72-25857
Apollo 9 thermal-control-coating degradation
[NASA-TN-D-6863] N72-25864
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[NASA-TM-X-68367] N72-25872
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Burn rate testing apparatus
[NASA-CASE-XMS-09690] N72-25913
Apollo experience report: Thermal protection from engine-plume environments
[NASA-TN-D-6844] N72-25922
Apollo experience report: Aerothermodynamics evaluation
[NASA-TN-D-6843] N72-25923
Reliability techniques in the petroleum industry N72-25986

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.

Underwater space suit pressure control regulator
[NASA-CASE-MFS-20332-2] N72-25124
Tilting table for ergometer and for other biomedical devices
[NASA-CASE-MFS-21010-1] N72-25127
Siloxane containing epoxide compounds
[NASA-CASE-MFS-13994-2] N72-25148
Silphenylenesiloxane polymers having in-chain perfluoroalkyl groups
[NASA-CASE-MFS-20979] N72-25151
Emergency lunar communications system
[NASA-CASE-MFS-21042] N72-25171
Pre-emphasis determination for an S-band constant bandwidth FM/FM station
[NASA-TM-X-64648] N72-25182
Lead attachment to high temperature devices
[NASA-CASE-ERC-10224] N72-25261
Redundant speed control for brushless Hall effect motor
[NASA-CASE-MFS-20207-1] N72-25267
Resonance-inert stabilization for space stations
[NASA-TN-D-6731] N72-25277
Device for measuring bearing preload
[NASA-CASE-MFS-20434] N72-25288
Accumulator
[NASA-CASE-MFS-10354-2] N72-25306
Supplement to the ICRPG turbulent boundary layer nozzle analysis computer program
[NASA-TM-X-64663] N72-25308
Noise elimination by piecewise cross correlation of photometer outputs N72-25381
Improved TIG weld joint strength in aluminum alloy 2219-T87 by filler metal substitution
[NASA-TM-X-64659] N72-25474
Omnidirectional wheel
[NASA-CASE-MFS-21309-1] N72-25480
Method and apparatus for nondestructive testing
[NASA-CASE-MFS-21233-1] N72-25627
Preliminary terrestrial based experiments on gravity-affected crystal growth
[NASA-TM-X-53999] N72-25693
Conjugate gradient determination of optimal plane changes for a class of three-impulse transfers between noncoplanar circular orbits
[NASA-TM-X-64662] N72-25809
Multiple in-line docking capability for rotating space stations
[NASA-CASE-MFS-20855-1] N72-25853
Natural environment design requirements for the Sortie module
[NASA-TM-X-64668] N72-25854
Applicability of NASA contract quality management and failure mode effect analysis procedures to the USGS Outer Continental Shelf oil and gas lease management program
[NASA-TM-X-2567] N72-25955
Contracting for system safety N72-25973

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D.C.

A simplified space technology method for clinical aircrew measurement of functional respiratory values
[NASA-TM-X-68370] N72-25057
Animal orientation and navigation
[NASA-SP-262] N72-25062
Two color horizon sensor
[NASA-CASE-ERC-10174] N72-25409
Measurement technology
[NASA-SP-5926(02)] N72-25421
Ultraviolet atomic emission detector
[NASA-CASE-HQN-10756-1] N72-25428
Sputtering and ion plating
[NASA-SP-5111] N72-25470
Optical pump and driver system for lasers
[NASA-CASE-ERC-10283] N72-25485
Satellite climatology
[NASA-TT-F-723] N72-25582
Physical studies of minor planets
[NASA-SP-267] N72-25753
Preliminary criteria for the fracture control of space shuttle structures
[NASA-SP-8095] N72-25851
Environmental statement for pioneer F/G program
[NASA-TM-X-68340] N72-25866
Government-Industry System Safety Conference
[NASA-TM-X-68369] N72-25961
Communicating the risk N72-25962
Reflections on system safety and the law N72-25965
Observations and reflections N72-25988

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[FAA-RD-72-46] N72-25426
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[NASA-CR-122394] N72-25423

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[NSRDS-NBS-40] N72-25807
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N72-25982

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N72-25984

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[NOAA-TR-NESS-55] N72-25583
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[NOAA-TM-NESS-29] N72-25721

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[RSD-66] N72-25331
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[NPL-DCS-14] N72-25167
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Algorithms for the production of contour maps over an irregular triangular mesh
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A tentative analysis of the bond types in binary metallurgical systems
[NPL-DCS-15] N72-25697

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[NASA-CR-126772] N72-25429

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[NRC-TT-1550] N72-25027
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N72-25365

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N72-25958
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N72-25974
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N72-25983

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[NOAA-TM-NWS-TDL-45] N72-25581

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N72-25034
Theory of development of reactions to whole body motion considered in relation to selection, assignment, and training of flight personnel
N72-25044
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N72-25037

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N72-25036

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N72-25043
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[AD-737207] N72-25113
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N72-25326
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N72-25977

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N72-25177
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N72-25415

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[P-4728] N72-25221
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[P-4772-1] N72-25332
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The JOSS years: Reflections on an experiment
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[AAR-99] N72-25225
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Hydrodynamic forces on an oscillating circular cylinder with a pair of trailing vortices developed behind the cylinder
N72-25293
An experimental investigation of nonequilibrium corner expansion flows of dissociated oxygen generated in a glow discharge shock tube
N72-25295
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N72-25324
Thermal and quasi-energetic plasma flow in the magnetosphere: Theoretical study
N72-25325
Vector measurements of the ion transport velocity with applications to F-region dynamics
N72-25328
Far-infrared observations of galactic H II regions
N72-25737
Search for hyperfine line from singly ionized helium-3 in galactic H-2 regions
N72-25741

ROCKEFELLER UNIV., NEW YORK.
Nocturnal bird migration in opaque clouds
N72-25073

ROCKETDYNE, CANOGA PARK, CALIF.
High-pressure oxygen impact tester
[NASA-CR-123643] N72-25418
Hydrazinium nitroformate propellant stabilized with nitroguanidine
[NASA-CASE-NPO-12000] N72-25699

ROME UNIV. [ITALY].
Microwave measurement of permittivity and loss factor of solids and liquids by a cavity perturbation method
[NOTA-INTERNA-352] N72-25637
Rigorous theory of the Boltzmann equation in the Lorentz gas
[NOTA-INTERNA-358] N72-25638
Line profile of the Q01[1] vibrational resonance in H2 in the zone of Dicke narrowing
[NOTA-INTERNA-349] N72-25662
Implications of gauge-invariance for pion electroproduction at threshold
[NOTA-INTERNA-354] N72-25663
Epsilon production in a geometrical approach
[NOTA-INTERNA-357] N72-25664
Elementary pion with transverse momentum cut off for inclusive processes
[NOTA-INTERNA-360] N72-25665
An experimental method for measuring heat transfer in hypersonic aerodynamic models
[REPT-32] N72-25918

ROYAL AIR FORCE HOSPITAL, WEGBERG [WEST GERMANY].
Problems in the clinical assessment of raised arterial blood pressure in aircrew
N72-25054

ROYAL AIR FORCE INST. OF AVIATION MEDICINE, FARNBOROUGH [ENGLAND].
Spatial disorientation and the break-off phenomena
N72-25042

ROYAL AIR FORCE, FARNBOROUGH [ENGLAND].
A review of United Kingdom [RAF and Army] statistics on spatial disorientation in flight 1960 - 1970
N72-25033
Improved methods of clinical electrodiagnosis in prognosis of lower motor neurone lesions
N72-25058

ROYAL AIR FORCE CENTRAL MEDICAL ESTABLISHMENT, LONDON [ENGLAND].
The disorientation accident: Philosophy of instrument flying training
N72-25046

ROYAL AIRCRAFT ESTABLISHMENT, BEDFORD [ENGLAND].
Some measurements of base pressure fluctuations at subsonic and supersonic speeds
[ARC-CP-1204] N72-24997

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH [ENGLAND].
A review of some published data on the external-flow jet-augmented flap
[ARC-CP-1194] N72-24998
An investigation of annular aerofoils for turbofan engine cowls
[ARC-R/M-3688] N72-24999
On the polarography of methaqualone, Dormutil and ethinazone, aolan. 5th report: Polarography of heterocycles
[RAE-LIB-TRANS-1608] N72-25165
Output filters for aircraft type cycloconvertors
[RAE-TR-71088] N72-25273
A simple method of measuring mist droplets by size and number
[RAE-LIB-TRANS-1627] N72-25302
Observations on the applicability of a rotating mirror camera, especially for investigations of moving self-luminous objects
[RAE-LIB-TRANS-1621] N72-25441
The effect of age-hardening processes on the behaviour of stress-strain curves
[RAE-LIB-TRANS-1525] N72-25525
A review of approach and landing guidance in relation to civil and military operational requirements
[RAE-TR-71186] N72-25606
An ILS approach programme unit for the radio environment monitor
[RAE-TR-71145] N72-25607
Analysis of the orbit Cosmos 268 rocket [1969-20B]
[RAE-TR-71202] N72-25838

ROYAL GREENWICH OBSERVATORY, HERSTMONCEUX [ENGLAND].
The equivalent widths of spectral lines in twelve late F dwarfs
[BULL-167] N72-25745
Spectral lines for curve-of-growth analysis of late-type stars, I
[BULL-168] N72-25746
Masses, radii and luminosities of RR Lyrae variable stars
[BULL-170] N72-25747

ROYAL INST. OF TECH., STOCKHOLM [SWEDEN].
Potential double layers in the ionosphere
[TRITA-EPP-72-07] N72-25395
Electric potential measurements by ion beam probing
[TRITA-EPP-71-26] N72-25674

S

SAARLAND UNIV., SAARBRUCKEN [WEST GERMANY].
Electron-phonon-coupling in A15-phases
N72-25644
Velocity of sound, lattice instability, and magnetic susceptibility in A15 phases
N72-25686

SAN JOSE STATE COLL., CALIF.
Disorientation incidents report by military pilots across 14 years of flight
[NASA-CR-126786] N72-25032

SANDIA LABS., ALBUQUERQUE, N.MEX.
Eleventh International Thermal Conductivity Conference
[CONF-710938] N72-25927

SCHJELDAHL [G. T.] CO., NORTHFIELD, MINN.
Comparison of polyester, film-yarn composite, balloon materials subjected to shear and biaxial loading
[NASA-CR-2047] N72-25546

SCHOOL OF AEROSPACE MEDICINE, BROOKS AFB, TEX.
Extended electrocardiographic monitoring with emphasis on computer analysis of the records
N72-25053

SCIENTIFIC TRANSLATION SERVICE, SANTA BARBARA, CALIF.
Evaluation of flight measurements and plotting of load collectives
[NASA-TT-F-14283] N72-24993
Solution of the Chaplygin equation by the method of straight lines
[NASA-TT-F-14254] N72-25303

SCOTT RESEARCH LABS., INC., PLUMSTEADVILLE, PA.
A study of aircraft powerplant emissions
[PB-207107] N72-25589

SCRIPPS INSTITUTION OF OCEANOGRAPHY, SAN DIEGO, CALIF.
When the beachhopper looks at the moon: The moon compass hypothesis
N72-25095

SENSORY SYSTEMS LAB., TUCSON, ARIZ.
Long range radio tracking of sea turtles and polar bear: Instrumentation and preliminary results
N72-25064

SHOCK HYDRODYNAMICS, INC., SHERMAN OAKS, CALIF.
STEEP32 computer code
[NASA-CR-126749] N72-25219

SMALL BUSINESS ADMINISTRATION, WASHINGTON, D.C.
Measurement technology
[NASA-SP-5926[02]] N72-25421

SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Meteor research program
[NASA-CR-112639] N72-25808
Nature and interpretation of the Apollo 11 lunar samples
N72-25820

SMITHSONIAN INSTITUTION, WASHINGTON, D.C.
Use of the Doppler technique to track free roaming animals from satellites
N72-25063
Satellite and ground radiotracking of elk
N72-25068
Cavity resonator for hydrogen maser
[NASA-CASE-HQN-10790-1] N72-25491
Wiley Post, his Winnie Mae, and the world's first pressure suit, number 8
N72-25952

SOUTHAMPTON UNIV. [ENGLAND].
The optimality of proportional navigation
[AASU-313] N72-25597

SOUTHERN METHODIST UNIV., DALLAS, TEX.
Studies to improve the estimation of seismological hypocenters and magnitudes
[AD-737405] N72-25404

SPECTROLAB, INC., SYLMAR, CALIF.
Apparatus for applying cover slides
[NASA-CASE-NPO-10575] N72-25019

SPERRY RAND CORP., ST. PAUL, MINN.
Conceptual design and feasibility evaluation model of a 10 to the 8th power bit oligatomic mass memory. Volume 1: Conceptual design
[NASA-CR-123635] N72-25213
Conceptual design and feasibility evaluation model of a 10 to the 8th power bit oligatomic mass memory. Volume 2: Feasibility evaluation model
[NASA-CR-123533] N72-25214
Conceptual design and feasibility evaluation model of a 10 to the 8th power bit oligatomic mass memory. Volume 3: Operation manual
[NASA-CR-123634] N72-25215

STANFORD RESEARCH INST., CALIF.
Lidar
N72-25357

STANFORD RESEARCH INST., MENLO PARK, CALIF.
Sferics
N72-25383

STANFORD UNIV., CALIF.
Wave propagation in a random medium
N72-25349
A review of transhorizon propagation as a possible tool for remote probing of the atmosphere
N72-25367
Advanced research in guidance, control, and instrumentation
[AD-738309] N72-25608

STATE UNIV. OF NEW YORK AT BUFFALO.
Tracking radar studies of bird migration
N72-25069

STATE UNIV. OF NEW YORK, BINGHAMTON.
The energy-momentum relation for weakly coupled optical polarons
N72-25653
Effect of hydrostatic pressure on the phonon spectrum of Pb-in alloys using electron tunneling
N72-25654

STATE UNIV. OF NEW YORK, STONY BROOK.
The navigation of homing pigeons: Do they use sun Navigation?
N72-25079
Comments on the possibility for determining detailed atmospheric structure from transhorizon radio propagation measurements
N72-25370
The composition of planetary atmospheres
N72-25817

STEVENS INST. OF TECH., HOBOKEN, N.J.
Proximity effect between superconductivity and normal metals
[NASA-CR-126771] N72-25682

SWISS NATIONAL FOUNDATION FOR SCIENTIFIC RESEARCH, MEIKIRCH.
Topography and pigeon orientation
N72-25077

SYLVANIA ELECTRONIC SYSTEMS-EAST, WALTHAM, MASS.
Incoherent and coherent CW laser systems for remote atmospheric probing
N72-25355

SYRACUSE UNIV., N.Y.
Theoretical study of corrugated plates: Shearing of a corrugated plate with curvilinear corrugations
[NASA-CR-2080] N72-25902

SYSTEMED CORP., NEWPORT BEACH, CALIF.
Effect of 90-day continuous exposure to methylisobutylketone on dogs, monkeys and rats
[NASA-CR-126744] N72-25102

SYSTEMS RESEARCH LABS., INC., DAYTON, OHIO.
Design, development, and application of a complete analog plasma-diagnostic system
[AD-738306] N72-25677

SYSTEMS TECHNOLOGY, INC., HAWTHORNE, CALIF.
Application of an approach and landing system model to the space shuttle orbiter vehicle
[NASA-CR-114465] N72-25875

T

TAPIA DE NAVARRO [GRACIELA], LA PAZ [BOLIVIA].
Scientific theory on the origin of the solar system
N72-25751

TECHNION - ISRAEL INST. OF TECH., HAIFA.
Dynamic inelastic behavior of materials
[AD-738326] N72-25538

TECHNISCH PHYSISCH DIENST TNO-TH, DELFT [NETHERLANDS].
Preliminary research on determining the ring spectrum in a cavity-tunnel
[TPD-1971-0-2] N72-25264
Determination of airborne sound generated by the air flow in a splitter type damper
[RVO-A70/KM/116] N72-25633

TECHNISCHE HOCHSCHULE DARMSTADT [WEST GERMANY].
Amplitude limiter and trigger switches with diodes
N72-25265
Properties and noise immunity of gate switches with hysteresis
N72-25266
Characterization of metric planes by transformation axioms
N72-25564

TECHNISCHE HOGESCHOOL, DELFT [NETHERLANDS].
Some applications of engineering mechanics in pressure vessel analysis
[WTHD-35] N72-25901

TECHNISCHE HOGESCHOOL, EINDHOVEN [NETHERLANDS].
Avalanche and microwave emission in N-type indium antimonide at liquid nitrogen temperature
N72-25684

TECHNISCHE UNIVERSITAET, BRUNSWICK [WEST GERMANY].
On the use of electronic data processing systems for operational input of electric switchgears
N72-25226
Experimental-numerical determination of residual stresses in austenite plated steel sheets
N72-25526
The kinetic energy density of a decaying electron gas as function of particle density in the presence of a linear effective potential
N72-25650

TECHNOLOGICAL LAB. RVO-TNO, RIJSWIJK [NETHERLANDS].
Control methods for 5 inch High-Velocity Aircraft Rockets [HVAR]
[TL-1971-7] N72-25849
Preliminary investigation of the vibration of the walls of the test cell for J-79-11A turbojet engine types
[TL-1971-11] N72-25898
Review of ignition systems. 2: The ignition of gunpowder
[TL-1971-16] N72-25919
Review of ignition systems. 3: Alternative methods for the research of gunpowder ignition
[TL-1971-17] N72-25920

TECHNOLOGY, INC., DAYTON, OHIO.
Gross behavior of the body's gluteal region
[AD-737225] N72-25110

TECHNOLOGY, INC., SAN ANTONIO, TEX.
Korotkov sound processor
[NASA-CASE-MSC-13999-1] N72-25142

TECHTRAN CORP., GLEN BURNIE, MD.
A vortex model dealing with the airstream at the rotor blade of a helicopter
[NASA-TT-F-14228] N72-24990
Lung ventilation and gas exchange of a man breathing different gas mixtures while swimming under water
[NASA-TT-F-14260] N72-25030
The Eole program
[NASA-TT-F-14279] N72-25345

TENNESSEE UNIV., KNOXVILLE.
Remote sensing of terrestrial vegetation: A comprehensive bibliography
N72-25327

TENNESSEE UNIV., TULLAHOMA.
An introduction to the laser
N72-25494
Principles of holography
N72-25495
Mathematical methods in coherent optical systems analysis. First order analysis of a holographic Schlieren system
N72-25496

TEXAS A&M UNIV., COLLEGE STATION.
Orientation through chemo reception in fishes
N72-25090
Planning and implementation of remote sensing experiments
[AD-737348] N72-25405
System safety education focused on industrial engineering
N72-25971

TEXAS CHRISTIAN UNIV., FORT WORTH.
Proceedings of the midwestern Psychological Association Symposium on Multivariate Approaches to Pattern Perception
[AD-737268] N72-25117

TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
RF heating of fusion reactors
[ORO-3778-5] N72-25615

TEXAS UNIV., AUSTIN.
Lunar laser ranging data deposited in the National Space Science Data Center: Unfiltered photon detections for September 1969 through June 1970
[NASA-CR-126747] N72-25486

TOULOUSE UNIV. [FRANCE].
Degradation of polymers used as insulators in electrical materials due to discharges
N72-25552

TRANSLATION CONSULTANTS, LTD., ARLINGTON, VA.
The extent of the zone of strong pitch angle diffusion of outer zone and plasma layer electrons during a substorm
[NASA-TT-F-14190] N72-25330

VIRGINIA UNIV., CHARLOTTESVILLE.
An instrument for recording soil temperature gradient
[NASA-TT-F-14262] N72-25425
The effect of austenite structure flaws on carbon diffusion
[NASA-TT-F-14272] N72-25516
The dislocation structure of alternately stressed austenitic steels
[NASA-TT-F-14267] N72-25521
Crystal structure of olivine
[NASA-TT-F-14243] N72-25687
The fusion crust of the Kunashak stony meteorite
[NASA-TT-F-14269] N72-25752

TRANSPORTATION SYSTEMS CENTER, CAMBRIDGE, MASS.
Aircraft wake vortex sensing systems
[DOT-TSC-FAA-72-13] N72-25313

TRW SYSTEMS GROUP, REDONDO BEACH, CALIF.
Failsafe multiple transformer circuit configuration
[NASA-CASE-NPO-11078] N72-25262
Pulsed laser holography
[NASA-CR-126767] N72-25501
Ruby laser holography
N72-25502
Feasibility study of a pressure-fed engine for a water recoverable space shuttle booster. Volume 1: Executive summary
[NASA-CR-123664] N72-25705
Feasibility study of a pressure-fed engine for a water recoverable space shuttle booster. Volume 2: Technical report
[NASA-CR-123667] N72-25706
Feasibility study of a pressure-fed engine for a water recoverable space shuttle booster. Volume 3, part 1: Program acquisition planning
[NASA-CR-123666] N72-25707
Feasibility study of a pressure-fed engine for a water recoverable space shuttle booster. Volume 3, Program acquisition planning part 2: program costs
[NASA-CR-123673] N72-25708
Feasibility study of a pressure-fed engine for a water recoverable space shuttle booster. Design data book
[NASA-CR-123674] N72-25709
Study of advanced techniques for determining the long-term performance of components
[NASA-CR-126720] N72-25845

TULANE UNIV., NEW ORLEANS, LA.
The sampling and analysis of a tracer gas in the combustion chamber of a liquid rocket engine
N72-25912

TYCO LABS., INC., WALTHAM, MASS.
The aluminum electrode in AlCl3-alkali-halide melts
[NASA-CR-126727] N72-25153

U

UNIROYAL, INC., MISHAWAKA, IND.
Development of a collapsible reinforced cylindrical space observation window
[NASA-CR-112085] N72-25852

UNITED AIRCRAFT CORP., EAST HARTFORD, CONN.
Restraint torso for a pressurized suit
[NASA-CASE-MSC-12397-1] N72-25119
Research and investigation of gas dynamic lasers
[NASA-CR-126718] N72-25488

UNIVERSITY COLL., LONDON [ENGLAND].
Global temperature and density structure in the lower thermosphere
[AD-738330] N72-25403

UNIVERSITY OF SOUTHERN CALIF., LOS ANGELES.
Abstract volume, National Coastal and Shallow Water Research Conference [Second]
[AD-735486] N72-25402
System safety education focused on flight safety
N72-25970

UPPSALA UNIV. [SWEDEN].
Modulation effects in the cosmic ray intensity and their dependence on sunspot number 10.7 cm radio flux and geomagnetic activity
[AD-737848] N72-25728

UTAH UNIV., SALT LAKE CITY.
Limiting amplitude calculations in solid rocket combustion instability
N72-25914

V

VIRGINIA POLYTECHNIC INST., BLACKSBURG.
Torsion pendulum measurements on viscoelastic materials during vacuum exposure
[NASA-CR-2074] N72-25548

VIRGINIA UNIV., CHARLOTTESVILLE.
Active microwave irises and windows
[NASA-CASE-LAR-10513-1] N72-25170

VOUGHT MISSILES AND SPACE CO., DALLAS, TEX.
Advanced Extravehicular Protective System [AEPS] study
[NASA-CR-114382] N72-25133

W

WASHINGTON UNIV., ST. LOUIS, MO.
The method of multiblade coordinates in the linear analysis of lifting rotor stability and gust response N72-25001
Neurophysiological analysis of echolocation in bats N72-25083
Zonal harmonic perturbations of satellite orbits N72-25738

WATERLOO UNIV. [ONTARIO].
Thermal instability in differentially heated inclined fluid layers: A generalization of the buoyancy driven stationary instability
[REPT-44] N72-25299
Potential flow of a vortex row with statistically varying spacings
[REPT-94] N72-25300
On a common theory for the stability of self-adjoint and non-self-adjoint mechanical systems
[REPT-64] N72-25459
Fatigue and creep failure of alpha-iron at 450-700 C
[TN-10] N72-25512
The influence of grain size and dispersion on the creep ductility of copper base alloys
[TN-12] N72-25513
A metallographic study of superplasticity in a micrograin aluminum bronze
[REPT-93] N72-25514
Superplasticity and cavitation in alpha-beta brass
[REPT-92] N72-25515
On a hybrid type of Galerkin's equation
[REPT-82] N72-25556
The algebraic eigenvalue problem: A set of FORTRAN subroutines
[REPT-18] N72-25557
Mechanical behaviour of polycrystals at elevated temperatures
[REPT-108] N72-25681
Behaviour of sand during undrained triaxial tests
[REPT-60] N72-25880
The loading-frequency relationship in multiple eigenvalue problems
[REPT-43] N72-25881
On the calculation of flutter loads by means of a variational technique
[REPT-105] N72-25882
On the analysis situs of eigenvalue curves of rods subjected to conservative and non-conservative loads
[REPT-107] N72-25883
Finite element analysis of the axisymmetric vibrations of cylinders
[REPT-106] N72-25884
On the sufficiency of the energy criterion for the stability of certain non-conservative systems of the follower-load type
[REPT-63] N72-25885
Investigation of stability of continuous non-conservative systems with damping by means of Liapunov's method
[REPT-66] N72-25886
The plates method and its application in the shell theory
[REPT-67] N72-25887
On a Maxwell-type solution of three-dimensional elasticity
[REPT-79] N72-25888
Randon buckling behaviour in axially loaded cylindrical shells with axisymmetric imperfections
[REPT-80] N72-25889
Stability of Hauger and Pfluger systems with Kelvin model and external damping
[REPT-102] N72-25890
Yield surfaces
[TN-1] N72-25891
Cyclic deformation and fatigue behaviour of axial and flexural members: A method of simulation and correlation
[TN-4] N72-25892
Optimum edge stiffeners for thin-walled structural elements
[TN-7] N72-25893
Multi-parameter optimal design of plates and shells
[REPT-109] N72-25894
Influence of Kelvin model damping in flutter-divergence transitional polygenic systems
[REPT-110] N72-25895
Elastic-plastic deformation analysis using linear programming
[REPT-88] N72-25896
The analysis and synthesis of resonators
[REPT-16] N72-25897
Creep and fatique fracture behaviour of Inconel alloy X-750
[TN-11] N72-25905

WEAPONS RESEARCH ESTABLISHMENT, SALISBURY [AUSTRALIA].
An assessment of the information recovered from the satellite WRESAT
[WRE-TN-516-[T]] N72-25195

WEST INDIES UNIV., KINGSTON [JAMAICA].
The laser radar above 30 kilometers N72-25359

WEST VIRGINIA UNIV., MORGANTOWN.
Analysis of a circulation controlled elliptical airfoil N72-24989

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Development of a solid electrolyte carbon dioxide and water reduction system for oxygen recovery
[NASA-CR-2014] N72-25125

WISCONSIN UNIV., MADISON.
Homing orientation in salamanders: A mechanism involving chemical cues N72-25092
Droplet fluid mechanics N72-25297
Identification of atmospheric structure by coherent microwave sounding N72-25368
Plasma instabilities and waves excited by an anisotropic energy distribution produced by electron cyclotron resonance
[COO-1695-39] N72-25671
Interstellar absorption of the Crab nebula's soft X-ray flux and the X-ray spectrum of the Crab pulsar N72-25734
A plausible energy source and structure for quasi-stellar objects
[NASA-CR-126723] N72-25742

WISCONSIN UNIV., MILWAUKEE.
Development of capabilities of optical diffraction analysis for quantitatively comparing and correlating rock fabrics and fabric changes
[AD-737390] N72-25408

WOLF RESEARCH AND DEVELOPMENT CORP., RIVERDALE, MD.
Antenna control system
[NASA-CR-122417] N72-25194

WORLD METEOROLOGICAL ORGANIZATION, GENEVA [SWITZERLAND].
Consolidated report on the voluntary assistance programme including projects approved for circulation in 1971
[WMO-323] N72-25591

X

XONICS, INC., VAN NUYS, CALIF.
Vortex observations by the Xonics acoustic radar at NAFEC
[FAA-RD-71-103] N72-25008

Y

YALE UNIV., NEW HAVEN, CONN.
Middle ear muscle contractions and their relation to pulse and echo evoked potentials in the bat N72-25084
Visual direction finding by fishes N72-25089

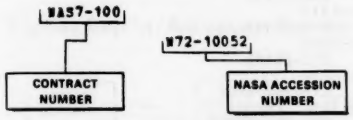
Z

ZARAGOZA UNIV. [SPAIN].
Contribution to the study of unsteady states in thermal diffusion columns N72-25667

ZURICH UNIV. [SWITZERLAND].
Visual orientation performances of desert ants [Cataglyphis bicolor] toward astromenotactic directions and horizon landmarks N72-25088

CONTRACT NUMBER INDEX

Typical Contract Number Index Listing



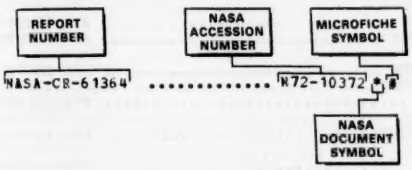
Listings in this index are arranged alphanumerically by contract number. Under each contract number, the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

A/M PROJ. 756
N72-25405
AEC ORDER SAN-71-325
N72-25487
AF PROJ. 6491
N72-25201
AF PROJ. 1508A
N72-25200
AF PROJ. 3145
N72-25028
N72-25678
AF PROJ. 3178
N72-25246
AF PROJ. 4152
N72-25677
AF PROJ. 4600
N72-25199
AF PROJ. 5102
N72-25608
AF PROJ. 5130
N72-25169
AF PROJ. 5629
N72-25839
AF PROJ. 6263
N72-25509
AF PROJ. 6302
N72-25102
AF PROJ. 7601
N72-25398
AF PROJ. 8600
N72-25728
AF PROJ. 8605
N72-25403
AF PROJ. 8652
N72-25404
AF PROJ. 8666
N72-25397
AF PROJ. 9560
N72-25318
N72-25320
AF PROJ. 9781
N72-25012
N72-25321
AF PROJ. 9782
N72-25538
AF 33(615)-141
N72-25608
AF-AFOSR-414-67
N72-25404
AF-AFOSR-616-67
N72-25359
AF-AFOSR-1804-69
N72-25012
AF-AFOSR-1879-70
N72-25070
AF-AFOSR-2078-71
N72-25559
ARPA ORDER 292-78
N72-25404
ARPA ORDER 1366
N72-25169
ARPA ORDER 1579
N72-25406
N72-25408
ARPA ORDER 1765
N72-25203
AT(04-3)-701 N72-25618
AT(11-1)-1695
N72-25671
AT(29-2)-1013
N72-25109
AT(29-2)-2831
N72-25616
AT(30-L)-1238
N72-25672
AT(30-1)-3554
N72-25092
AT(33-1)-GEN-53
N72-25535
AT(40-1)-3778
N72-25615
AT(40-1)-4049
N72-25659
DA PROJ. 1T0-61102-B-11A
N72-25537
DA PROJ. 1T0-61102-B-81A
N72-25117
DA-31-124-ARO-D-270
N72-25558
DAAB07-67-C-0199
N72-25698
DAAB07-71-C-0300
N72-25840
DAAD05-68-C-0176
N72-25117
DAHC15-69-C-0347
N72-25224
DAHC19-69-C-0017
N72-25991
DAHC19-70-G-0026
N72-25666
DGRST-68/470 N72-25283
DI-BM-HO210003
N72-25408
DI-14-06-D-6039
N72-25401
DOT-FA70WA-2315
N72-25011
DOT-FA71WA-2672
N72-25008
DOT-FA72WA-2727
N72-25154
DOT-IA-FA-205
N72-25313
DOT/TSC PROJ. R-2106
N72-25313
DRB-9535-49 N72-25892
DRME-69.34.359-00-480
N72-25243
DRME-71.34.104
N72-25507
DSR PROJ. 55-23890
N72-25604
E-2-68(N) N72-25718
EPA-EHSD-71-34
N72-25510
EPA-68-04-0027
N72-25593
EPA-68-04-0037
N72-25589
ESTEC-1369-71-CG
N72-25909
ESTEC-1465-71-EL
N72-25445
N72-25446
FAA PROJ. 076-311-01X
N72-25426
FAA PROJ. 320-114-02X
N72-25605
FR-504 N72-25083
FR-5445-09 N72-25085
FR-C7C54 N72-25083
F04611-67-C-0105
N72-25501
F04701-68-C-0110
N72-25349
F04701-70-C-0057
N72-25246
F19628-69-C-0263
N72-25169
F19628-70-C-0230
N72-25200
N72-25201
F29601-69-C-0023
N72-25910
F30602-71-C-0152
N72-25202
F30602-71-C-0214
N72-25203
F33615-67-C-1814
N72-25500
F33615-68-C-1310
N72-25500
F33615-68-C-1398
N72-25677
F33615-68-C1119
N72-25501
F33615-69-C-1251
N72-25698
F33615-69-C-1630
N72-25502
F33615-69-C-1831
N72-25028
F33615-70-C-1046
N72-25102
F33615-70-C-1637
N72-25608
F44620-69-C-0022
N72-25318
N72-25320
F44620-71-C-0004
N72-25321
F44620-71-C-0071
N72-25199
F61052-67-C-0042
N72-25839
F61052-68-C-0034
N72-25728
F61052-68-C-0057
N72-25403
F61052-69-C-0042
N72-25538
F61052-70-C-0009
N72-25398
F61052-70-C-0014
N72-25676
GM-44846 N72-25092
HD-02319 N72-25080
IITRI PROJ. E6205
N72-25179
JPL-952023 N72-25501
MH-04453 N72-25080
MRI PROJ. 3332-E(D)
N72-25101
NASA ORDER L-43531
N72-24995
NASA ORDER S-4749A-G
N72-25423
NASA ORDER T-64130G
N72-25102
NASA ORDER W-12596
N72-25347
NASA ORDER W-12996
N72-25029
NASA-SNSO-IA-13254
N72-25611
NASW-1572 N72-25501
NASW-1936 N72-25101
NASW-1983 N72-25068
NASW-1998 N72-25476
NASW-2035 N72-24993
N72-25303
NASW-2037 N72-24990
N72-25030
N72-25345
NASW-2038 N72-25330
N72-25425
N72-25516
N72-25521
N72-25687
N72-25752
NASW-2062 N72-25105
NASW-2114 N72-25429
NASW-2119 N72-25334
N72-25335
NASW-2181 N72-25488
NASW-2235 N72-25702
NAS1-6666 N72-25711
N72-25712
N72-25713
N72-25714
N72-25715
NAS1-8896 N72-25125
NAS1-9603 N72-24991
NAS1-10043 N72-25548
NAS1-10076 N72-25852
NAS1-10353 N72-25547
NAS1-10359 N72-25126
NAS1-10514 N72-25128
NAS1-10536 N72-24992
NAS1-10750 N72-25546
NAS2-6022 N72-25133
NAS2-6077 N72-25599
NAS2-6118 N72-25134
NAS2-6275 N72-25875
NAS2-6477 N72-25005
NAS3-13326 N72-25159
NAS3-14363 N72-25158
NAS3-14408 N72-25024
NAS5-3095 N72-25726
N72-25727
NAS5-3352 N72-25376
NAS5-9756-192
N72-25194
NAS5-10618 N72-25830
NAS5-11388 N72-25270
NAS5-11609 N72-25871
NAS5-11675 N72-25478
NAS5-21025 N72-25710
NAS5-21390 N72-25551
NAS5-21623 N72-25179
NAS7-100 N72-25026
N72-25192
N72-25193
N72-25222
N72-25269
N72-25276
N72-25309
N72-25492
N72-25522
N72-25545
N72-25563
N72-25609
N72-25610
N72-25628
N72-25648
N72-25668
N72-25688
N72-25703
N72-25704
N72-25925
N72-25928
NAS7-782 N72-25845
NAS7-791 N72-25301
NAS8-4016 N72-25858
N72-25859
N72-25863
NAS8-21810 N72-25836
NAS8-25918 N72-25219
NAS8-25987 N72-25275
NAS8-26464 N72-25305
NAS8-26658 N72-25336
NAS8-26670 N72-25213
N72-25214
N72-25215
NAS8-26703 N72-25289

NAS8-26772 N72-25843
N72-25844
NAS8-27009 N72-25465
NAS8-27014 N72-25464
NAS8-27041 N72-25542
NAS8-27359 N72-25216
N72-25217
NAS8-27480 N72-25418
NAS8-27793 N72-25916
NAS8-28217 N72-25700
N72-25701
NAS8-28218 N72-25705
N72-25706
N72-25707
N72-25738
N72-25709
NAS9-4065 N72-25604
NAS9-7180 N72-25061
NAS9-7675 N72-25142
NAS9-8095 N72-25754
NAS9-8096 N72-25754
NAS9-8843 N72-25754
NAS9-9492 N72-25343
NAS9-10441 N72-25230
N72-25231
N72-25232
NAS9-10741 N72-25143
NAS9-11160 N72-25874
NAS9-11842 N72-25867
NAS9-11947 N72-25862
NAS9-11993 N72-25744
NAS9-12200 N72-25743
NAS10-4967 N72-25218
NAS12-688 N72-25153
NAS12-2093 N72-25224
NBO-7229-02 N72-25085
NBS PROJ. 4253440
N72-25487
NGL-05-002-007
N72-25726
NGL-05-046-002
N72-25032
NGL-21-002-033
N72-25723
NGL-31-003-020
N72-25682
NGL-33-010-054
N72-25631
NGL-36-008-106
N72-25917
NGL-40-002-015
N72-25559
NGL-40-002-059
N72-25639
NGL-50-002-044
N72-25742
NGR-03-041-001
N72-25064
NGR-05-003-278
N72-25743
NGR-05-007-002
N72-25823
NGR-05-007-116
N72-25640
NGR-05-007-190
N72-25640
NGR-09-010-070
N72-25915
NGR-10-007-010
N72-25921
NGR-14-005-181
N72-25329
NGR-22-004-024
N72-25191
NGR-22-009-016
N72-25373
NGR-22-009-114
N72-25360
NGR-22-009-131
N72-25360
NGR-22-009-312
N72-25144
NGR-22-009-393
N72-25224
NGR-23-005-004
N72-25683
NGR-31-001-146
N72-25623
NGR-33-010-101
N72-25624
NGR-33-022-115
N72-25902
NGR-33-101-082
N72-25624
NGR-34-001-019
N72-25078
N72-25080
NGR-36-008-080
N72-25180
NGR-40-002-015
N72-25558
NGR-44-012-219
N72-25486
NONR-266(84) N72-25388
NONR-1181 N72-25080
NONR-4315(00)
N72-25064
NR PROJ. 196-070
N72-25116
NR PROJ. 213-065
N72-25015
N72-25016
N72-25017
N72-25018
NRC A-1694 N72-25892
NRC A-2696 N72-25880
NRC A-7297 N72-25556
N72-25882
N72-25883
N72-25885
N72-25886
N72-25888
N72-25890
N72-25895
NRC D-10 N72-25887
NS-05427-07CMS
N72-25087
NSF GA-1291 N72-25368
NSF GA-1310X N72-25374
NSF GA-23945 N72-25624
NSF GA-25660 N72-25337
NSF GB-2469 N72-25095
NSF GB-2496 N72-25092
NSF GB-2952 N72-25078
NSF GB-3155 N72-25065
NSF GB-5471 N72-25095
NSF GB-5969X N72-25082
NSF GB-6680 N72-25065
NSF GB-6777 N72-25079
NSF GB-7155 N72-25073
NSF GB-13046X
N72-25098
NSF GB-13246 N72-25069
NSF GB-13904 N72-25083
NSF GJ-432 N72-25224
NSF GJ-1049 N72-25224
NSF GJ-32258X
N72-25188
NSF GK 2120 N72-25205
NSF GK-730 N72-25322
NSF GK-1903 N72-25318
NSF GK-17748 N72-25320
NSF GK-31073X
N72-25559
NSF GP-667 N72-25368
NSF GP-4352 N72-25368
NSF GP-18062 N72-25813
NSF GP-25303 N72-25642
NSF GP-25306 N72-25629
NSF GP-32453 N72-25225
N72-25229
NSF GZ-259 N72-25069
NSR-06-004-063
N72-25482
N72-25953
N72-25954
NSR-09-015-033
N72-25808
NSR-09-015-098
N72-25491
N00014-67-A-0151-0021
N72-25672
N00014-68-C-0289
N72-25015
N72-25016
N72-25017
N72-25018
N00014-69-A-0276-0002
N72-25224
N00014-70-A-0362-0001
N72-25224
N00014-70-C-0189
N72-25116
N00017-62-C-0604
N72-25639
N00039-71-C-0111
N72-25111
N00156-71-C-0854
N72-25110
N62306-71-C-0029
N72-25405
ORA PROJ. 043810
N72-25683
PROJ. SQUID N72-25304
RF PROJ. 2601
N72-25917
W-7405-ENG-26
N72-25635
N72-25658
N72-25660
W-7405-ENG-36
N72-25442
W-7405-ENG-48
N72-25443
N72-25613
076-00-00-00-72
N72-25099
N72-25855
111-03 N72-25523
111-05-31-01-00-21
N72-24994
112-02 N72-25646
113-34 N72-25025
114-03-50-01 N72-25924
114-08-05-02 N72-24992
115-21-01-01 N72-25865
117-07-04-15-00-21
N72-25290
127-53-41-05 N72-25125
129-01-20-09-00
N72-25631
132-15 N72-25468
134-03 N72-25161
134-14-05-02 N72-25902
N72-25904
160-44-05-28-25
N72-25424
736-05-10-01 N72-24991
815-20-09-03-05
N72-25546
908-10-08-0000
N72-25277
914-11-00-00-72
N72-25187
N72-25864
914-11-20-10-72
N72-25923
914-11-20-12-72
N72-25922
914-13-20-13-72
N72-25903
914-50-DJ-96-72
N72-25856
914-50-00-00-72
N72-25186
914-50-20-20-72
N72-25857
914-50-95-89-72
N72-25100
914-89-00-00-72
N72-25475
924-22-20-00-72
N72-25223
924-22-20-11-72
N72-25600
970-12-10-21-10
N72-25144

REPORT/ACCESSION NUMBER INDEX

Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche. A plus sign (+) indicates a document that can not be microfiched but for which one-to-one facsimile is available.

A-4341 ..... N72-25290*#
A-4342 ..... N72-24994*#

A/CONF.49/P-56 ..... N72-25612*#

AAR-90 ..... N72-25229 #
AAR-99 ..... N72-25225 #

AASU-313 ..... N72-25597 #

ACIC-TC-1777 ..... N72-25399 #
ACIC-TC-1781 ..... N72-25400 #

AD-735296 ..... N72-25011 #
AD-735486 ..... N72-25402 #
AD-735619 ..... N72-25246 #
AD-735775 ..... N72-25407 #
AD-736769 ..... N72-25028 #
AD-737100 ..... N72-25910 #
AD-737108 ..... N72-25400 #
AD-737110 ..... N72-25399 #
AD-737207 ..... N72-25113 #
AD-737208 ..... N72-25114 #
AD-737209 ..... N72-25115 #
AD-737220 ..... N72-25118 #
AD-737225 ..... N72-25110 #
AD-737237 ..... N72-25111 #
AD-737268 ..... N72-25117 #
AD-737282 ..... N72-25406 #
AD-737348 ..... N72-25405 #
AD-737351 ..... N72-25112 #
AD-737376 ..... N72-25116 #
AD-737390 ..... N72-25408 #
AD-737405 ..... N72-25404 #
AD-737611 ..... N72-25014 #
AD-737814 ..... N72-25840 #
AD-737832 ..... N72-25678 #
AD-737839 ..... N72-25169 #
AD-737848 ..... N72-25728 #
AD-737849 ..... N72-25199 #
AD-737850 ..... N72-25839 #
AD-737856 ..... N72-25318 #
AD-737859 ..... N72-25012 #
AD-737909 ..... N72-25592 #
AD-737910 ..... N72-25698 #
AD-738005 ..... N72-25666 #
AD-738006 ..... N72-25015 #
AD-738007 ..... N72-25016 #
AD-738008 ..... N72-25017 #
AD-738009 ..... N72-25018 #
AD-738118 ..... N72-25991 #
AD-738120 ..... N72-25484 #
AD-738124 ..... N72-25574 #
AD-738132 ..... N72-25204 #
AD-738135 ..... N72-25145 #
AD-738162 ..... N72-25537 #
AD-738218 ..... N72-25676 #
AD-738255 ..... N72-25319 #
AD-738269 ..... N72-25274 #
AD-738270 ..... N72-25508 #
AD-738271 ..... N72-25483 #
AD-738272 ..... N72-25536 #
AD-738288 ..... N72-25509 #
AD-738296 ..... N72-25168 #
AD-738297 ..... N72-25200 #
AD-738298 ..... N72-25201 #
AD-738303 ..... N72-25202 #
AD-738304 ..... N72-25320 #
AD-738305 ..... N72-25203 #
AD-738306 ..... N72-25677 #
AD-738309 ..... N72-25608 #
AD-738316 ..... N72-25398 #
AD-738326 ..... N72-25538 #
AD-738327 ..... N72-25397 #
AD-738330 ..... N72-25403 #
AD-738335 ..... N72-25321 #

AEC-TR-7175 ..... N72-25641 #

AERON-47 ..... N72-25329*#

AERONOMICA-ACTA-A-97-1972 ..... N72-25837 #

AERONOMY-46 ..... N72-25337 #

AEWES-TR-3-712-SUPPL-5 ..... N72-25407 #

AFAL-TR-71-121 ..... N72-25509 #
AFAL-TR-71-256 ..... N72-25608 #
AFAL-TR-71-294 ..... N72-25677 #

AFAPL-TR-71-60 ..... N72-25678 #
AFAPL-TR-71-99 ..... N72-25028 #

AFCRL-SR-126 ..... N72-25397 #

AFCRL-71-0540 ..... N72-25728 #
AFCRL-71-0566 ..... N72-25403 #
AFCRL-71-0576 ..... N72-25397 #
AFCRL-71-0610 ..... N72-25199 #
AFCRL-71-0620 ..... N72-25169 #
AFCRL-72-0103 ..... N72-25839 #
AFCRL-72-0116 ..... N72-25398 #

AFOSR-71-2317TR ..... N72-25318 #
AFOSR-71-3106TR ..... N72-25321 #
AFOSR-72-0033TR ..... N72-25012 #
AFOSR-72-0076TR ..... N72-25320 #
AFOSR-72-0426TR ..... N72-25404 #
AFOSR-72-0562TR ..... N72-25538 #

AFRPL-TR-72-15 ..... N72-25168 #

AFWL-TR-71-103-VOL-1 ..... N72-25910 #

AGARD-AG-159 ..... N72-25346 #
AGARD-AG-160-VOL-3 ..... N72-25420 #

AGARD-AR-43 ..... N72-25419 #

AGARD-CP-95-PT-1 ..... N72-25031 #
AGARD-CP-95-PT-2 ..... N72-25048 #

AGARD-LS-49 ..... N72-25493 #

AGARDOGRAPH-159 ..... N72-25346 #
AGARDOGRAPH-160-VOL-3 ..... N72-25420 #

AI-AEC-13017 ..... N72-25618 #

AMMEC-TR-71-47 ..... N72-25537 #

AMRL-TR-71-58 ..... N72-25038 #
AMRL-TR-71-59 ..... N72-25040 #
AMRL-TR-71-65 ..... N72-25102*#

AMS-1009 ..... N72-25623*#

AP-70-6640 ..... N72-25711*#
AP-70-6800 ..... N72-25713*#
AP-70-6939 ..... N72-25712*#
AP-70-7035 ..... N72-25714*#
AP-71-7279 ..... N72-25715*#
AP-100 ..... N72-25588 #

APTD-0916 ..... N72-25589 #
APTD-0918 ..... N72-25510 #

AR-1 ..... N72-25408 #

ARAP-168 ..... N72-25321 #

ARC-CP-1194 ..... N72-24998 #
ARC-CP-1196 ..... N72-25314 #
ARC-CP-1197 ..... N72-25315 #
ARC-CP-1199 ..... N72-25010 #
ARC-CP-1201 ..... N72-25316 #
ARC-CP-1203 ..... N72-25000 #
ARC-CP-1204 ..... N72-24997 #
ARC-CP-1206 ..... N72-25009 #

ARC-R/M-3688 ..... N72-24999 #

ARC-30371 ..... N72-25315 #
ARC-31421 ..... N72-25316 #
ARC-31955 ..... N72-25314 #
ARC-32372 ..... N72-25000 #
ARC-32714 ..... N72-24998 #
ARC-33108 ..... N72-25009 #

ARL/C/N9 ..... N72-25319 #
ARL/MET-86 ..... N72-25691 #
ARL/SM-REPT-334 ..... N72-25899 #
ARL/SM-332 ..... N72-24996 #

ASG-2-554C ..... N72-25159*#

ASWE-TR-71-30 ..... N72-25274 #

BAC-6272-933010 ..... N72-25599*#

BBC-1972/12 ..... N72-25731
BBC-1972/13 ..... N72-25176
BBC-1972/14 ..... N72-25175
BBC-1972/15 ..... N72-25416

BIOTEL-S-57 ..... N72-25191*#

BM-BULL-658 ..... N72-25228 #

BM-RI-7538 ..... N72-25518 #
BM-RI-7543 ..... N72-25472 #
BM-RI-7577 ..... N72-25473 #
BM-RI-7634 ..... N72-25584 #
BM-RI-7635 ..... N72-25520 #
BM-RI-7638 ..... N72-25519 #

BNL-50321(UC-33) ..... N72-25611*#

BR25396 ..... N72-25525 #
BR26007 ..... N72-25273 #
BR27181 ..... N72-25606 #
BR27242 ..... N72-25838 #
BR27441 ..... N72-25607 #
BR27904 ..... N72-25274 #
BR28698 ..... N72-25302 #
BR29171 ..... N72-25441 #
BR29233 ..... N72-25165 #
BR30016 ..... N72-25508 #

BSR-3129-VOL-1 ..... N72-25334*#
BSR-3129-VOL-2 ..... N72-25335*#

BULL-167 ..... N72-25745 #
BULL-168 ..... N72-25746 #
BULL-170 ..... N72-25747 #

C-136 ..... N72-25424*#

CAF-DOC-582 ..... N72-25002

CAL-IH-3037-J-1 ..... N72-25128*#

CDS-TR-72-2 ..... N72-25559*#

CEA-CONF-1871 ..... N72-25656 #

CEA-R-4129 ..... N72-25533 #

CERN-71-28 ..... N72-25634 #

CNRS-AO-4091 ..... N72-25643 #

CONF-710901-8 ..... N72-25612*#
CONF-710932-2 ..... N72-25656 #
CONF-710938 ..... N72-25927 #
CONF-711021-8 ..... N72-25613 #

CONTRIB-62 ..... N72-25358*#
CONTRIB-74 ..... N72-25087*#

COO-1695-39 ..... N72-25671 #

CRSR-483 ..... N72-25624*#

CS-7140-R0202-PT-B ..... N72-25246 #

D-103 ..... N72-25330*#

DISS-4460 ..... N72-25567 #
DISS-4600 ..... N72-25689 #
DISS-4608 ..... N72-25279 #
DISS-4623 ..... N72-25477 #
DISS-4624 ..... N72-25568 #
DISS-4653 ..... N72-25566 #
DISS-4656 ..... N72-25690 #
DISS-4661 ..... N72-25271 #
DISS-4670 ..... N72-25572 #
DISS-4673 ..... N72-25272 #
DISS-4676 ..... N72-25570 #
DISS-4684 ..... N72-25651 #
DISS-4705 ..... N72-25163 #
DISS-4707 ..... N72-25565 #
DISS-4727 ..... N72-25569 #
DISS-4746 ..... N72-25162 #

DLR-FB-71-107 ..... N72-25317 #

DLR-MIT-70-16 ..... N72-25441 #

DLR-MITT-70-01 ..... N72-24993*#

DMS-DR-1192 ..... N72-25859*#
DMS-DR-1206 ..... N72-25863*#
DMS-DR-1221 ..... N72-25858*#

DO-149 ..... N72-25603 #

DOC-70SD5399 ..... N72-25143*#

DOT-TSC-FAA-72-13 ..... N72-25313 #

DR-214 ..... N72-25930 #

DRIC-TRANS-2644 ..... N72-25508 #

DRL-T-628 ..... N72-25862*#

D6A-12108-1-VOL-1 ..... N72-25011 #
D162-10125-2A-VOL-1 ..... N72-25015 #
D162-10127-2A-VOL-3 ..... N72-25016 #
D162-10128-2A-VOL-4 ..... N72-25017 #
D162-10129-2A-VOL-5 ..... N72-25018 #

E-16-612 ..... N72-25336*#
E-6751 ..... N72-25543*#
E-6753 ..... N72-25523*#
E-6777 ..... N72-25161*#
E-6819 ..... N72-25468*#
E-6836 ..... N72-25646*#
E-6866 ..... N72-25025*#
E-6903 ..... N72-25544*#
E-6904 ..... N72-25022*#
E-6905 ..... N72-25023*#

EFSTC-HT-23-472-71 ..... N72-25574 #

ELR-1585 ..... N72-25866*#

ENEA-71-45 ..... N72-25007 #

EQ-71-2 ..... N72-25011 #

ERL-224 ..... N72-25406 #

ERO-1-1972 ..... N72-25014 #

ER71-4457 ..... N72-25203 #

ESD-TR-71-324 ..... N72-25200 #
ESD-TR-72-55-PT-1 ..... N72-25201 #

ESRO-CR(P)-77 ..... N72-25445 #
ESRO-CR(P)-78 ..... N72-25446 #
ESRO-CR(P)-79 ..... N72-25909 #

ESRO-SP-69 ..... N72-25233 #

ETN-5 ..... N72-25990 #

EUR-CEA-FC-615 ..... N72-25669 #
EUR-CEA-FC-624 ..... N72-25670 #

EUR-4716 ..... N72-25655 #

EURFNR-954 ..... N72-25534 #

FAA-AM-72-1 ..... N72-25103 #
FAA-AM-72-9 ..... N72-25130 #
FAA-AM-72-10 ..... N72-25131 #
FAA-AM-72-11 ..... N72-25108 #
FAA-AM-72-13 ..... N72-25104 #
FAA-AM-72-14 ..... N72-25132 #

FAA-NA-72-6 ..... N72-25426 #
FAA-NA-72-11 ..... N72-25605 #

FAA-RD-71-103 ..... N72-25008 #
FAA-RD-72-4 ..... N72-25605 #
FAA-RD-72-46 ..... N72-25426 #

FFA-MEMO-77 ..... N72-25302 #

FP/LP-DR5-1.501/71 ..... N72-25243 #

FRNC-TH-138 ..... N72-25657 #

FZM-5917 ..... N72-25464*#

GE-7CSD5386 ..... N72-25143*#

HEL-TM-25-71 ..... N72-25117 #
HEL-TM-27-71 ..... N72-25204 #

HEL-TN-1-72 ..... N72-25145 #

HPM-2 ..... N72-25916*#

HREC-6772-1-VOL-1 ..... N72-25843*#
HREC-6772-2-VOL-2 ..... N72-25844*#

IC-AERO-72-01 ..... N72-25312 #
IC-AERO-72-03 ..... N72-25311 #
IC-AERO-72-05 ..... N72-25310 #

IIT-THEMIS-R71-6 ..... N72-25320 #

IIT-THEMIS-71-2-AUG-71 ..... N72-25318 #

IITRI-E6185-1 ..... N72-25111 #

IITRI-L6046-55 ..... N72-25061*#

ILL-(TH)-72-5 ..... N72-25642 #

INRS-14/RE-A ..... N72-25908 #

IPP-4/91 ..... N72-25696 #

IR-5 ..... N72-25401 #

IRI-133-71-06 ..... N72-25661 #

ISL-29/71 ..... N72-25282 #
ISL-37/71 ..... N72-25444 #
ISL-41/71 ..... N72-25507 #

ISS-71/20 ..... N72-25652 #

ITDR-10 ..... N72-25713*#
ITDR-11 ..... N72-25714*#
ITDR-12 ..... N72-25715*#
ITDR-15 ..... N72-25712*#

ITR-14 ..... N72-25711*#

JANAIR-701213-VOL-1 ..... N72-25015 #
JANAIR-701214-VOL-3 ..... N72-25016 #
JANAIR-701215-VOL-4 ..... N72-25017 #
JANAIR-701216 ..... N72-25018 #

JPL-TM-33-532 ..... N72-25688*#
JPL-TM-33-533 ..... N72-25522*#
JPL-TM-33-535 ..... N72-25192*#
JPL-TM-33-536 ..... N72-25026*#
JPL-TM-33-537 ..... N72-25193*#
JPL-TM-33-538 ..... N72-25925*#
JPL-TM-33-539 ..... N72-25276*#
JPL-TM-33-540 ..... N72-25309*#
JPL-TM-33-541 ..... N72-25648*#
JPL-TM-33-542 ..... N72-25563*#
JPL-TM-33-545 ..... N72-25609*#
JPL-TM-33-546 ..... N72-25610*#
JPL-TM-33-547 ..... N72-25545*#
JPL-TM-33-549 ..... N72-25704*#
JPL-TM-33-550 ..... N72-25703*#
JPL-TM-33-551 ..... N72-25668*#

JPL-TR-32-1557 ..... N72-25492*#

JPRS-55354 ..... N72-25189 #
JPRS-55985 ..... N72-25824 #
JPRS-56070 ..... N72-25527 #
JPRS-56072 ..... N72-25135 #
JPRS-56099 ..... N72-25430 #
JPRS-56106 ..... N72-25959 #
JPRS-56129 ..... N72-25106 #
JPRS-56130 ..... N72-25692 #
JPRS-56134 ..... N72-25868 #
JPRS-56143 ..... N72-25185 #
JPRS-56154 ..... N72-25834 #

KFK-EXT-3/71-10 ..... N72-25695 #

KFK-1463 ..... N72-25534 #
KFK-1550 ..... N72-25989 #

KGO-722 ..... N72-25393 #
KGO-724 ..... N72-25392 #

KHFTI-70-67 ..... N72-25673 #

L-6283 ..... N72-25924*#
L-6547 ..... N72-25904*#
L-8181 ..... N72-25865*#

LA-TR-71-79 ..... N72-25673 #

LA-4832 ..... N72-25442 #

LBL-304 ..... N72-25613 #

LC-75-611767 ..... N72-25062*#
LC-78-176235 ..... N72-25476*#
LC-79-179666 ..... N72-25807 #

LF-44 ..... N72-25109 #

LMSC-HREC-D225700-1 ..... N72-25843*#
LMSC-HREC-D225700-2-VOL 2 ..... N72-25844*#
LMSC-HREC-D225737 ..... N72-25465*#

LR-560 ..... N72-25900 #

LSI-ER-131-16 ..... N72-25134*#

M-214 ..... N72-25277*#
M-244-1082 ..... N72-25836*#

MAE-1833-T4 ..... N72-25902*#

MBB-UR-V-48 ..... N72-25909 #

MCIC-72-03 ..... N72-25483 #
MCIC-72-05 ..... N72-25536 #

MCR-72-81 ..... N72-25275*#

MED-34 ..... N72-25538 #

MFI-71-115 ..... N72-25116 #

MLM-1864 ..... N72-25535 #

MMTC-2 ..... N72-25406 #

MSC-PA-R-69-2 ..... N72-25846*#

MSC-S-287 ..... N72-25923*#
MSC-S-293 ..... N72-25922*#
MSC-S-294 ..... N72-25856*#
MSC-S-295 ..... N72-25855*#
MSC-S-314 ..... N72-25864*#
MSC-S-316 ..... N72-25903*#
MSC-S-320 ..... N72-25187*#
MSC-S-322 ..... N72-25186*#
MSC-S-323 ..... N72-25600*#
MSC-S-325 ..... N72-25857*#
MSC-S-326 ..... N72-25223*#
MSC-S-328 ..... N72-25100*#
MSC-S-330 ..... N72-25475*#
MSC-S-332 ..... N72-25099*#

MSC-00171 ..... N72-25846*#
MSC-03773 ..... N72-25862*#
MSC-03810-B-1 ..... N72-25874*#
MSC-04217-REV-B ..... N72-25873*#
MSC-04217-VOL-1-REV-B ..... N72-25872*#
MSC-05161-SUPPL-6 ..... N72-25183*#
MSC-05805 ..... N72-25848*#

MSFC-SE-019-010-2H ..... N72-25701*#
MSFC-SE-019-014-2H ..... N72-25700*#

NADC-CS-7121 ..... N72-25110 #

NAMRL-1152 ..... N72-25118 #

NASA-CASE-ARC-10325 ..... N72-25147*
NASA-CASE-ARC-10463-1 ..... N72-25268*#
NASA-CASE-ARC-10599-1 ..... N72-25129*#

NASA-CASE-ERC-10048 ..... N72-25251*
NASA-CASE-ERC-10174 ..... N72-25409*
NASA-CASE-ERC-10224 ..... N72-25261*
NASA-CASE-ERC-10268 ..... N72-25252*
NASA-CASE-ERC-10275 ..... N72-25680*
NASA-CASE-ERC-10283 ..... N72-25485*
NASA-CASE-ERC-10292 ..... N72-25410*
NASA-CASE-ERC-10324 ..... N72-25173*
NASA-CASE-ERC-10325 ..... N72-25457*
NASA-CASE-ERC-10363 ..... N72-25541*
NASA-CASE-ERC-10364 ..... N72-25540*
NASA-CASE-ERC-10403-1 ..... N72-25280*#

NASA-CASE-FRC-10029-2 ..... N72-25121*

NASA-CASE-GSC-10565-1 ..... N72-25149*
NASA-CASE-GSC-10656-1 ..... N72-25249*
NASA-CASE-GSC-10695-1 ..... N72-25259*
NASA-CASE-GSC-10879-1 ..... N72-25413*
NASA-CASE-GSC-11018-1 ..... N72-25871*#
NASA-CASE-GSC-11126-1 ..... N72-25253*
NASA-CASE-GSC-11211-1 ..... N72-25020*

NASA-CASE-HQN-10756-1 ..... N72-25428*#
NASA-CASE-HQN-10790-1 ..... N72-25491*#

NASA-CASE-KSC-10385 ..... N72-25211*
NASA-CASE-KSC-10397 ..... N72-25206*
NASA-CASE-KSC-10513 ..... N72-25453*
NASA-CASE-KSC-10565 ..... N72-25250*
NASA-CASE-KSC-10654-1 ..... N72-25184*#

NASA-CASE-LAR-10163-1 ..... N72-25247*
NASA-CASE-LAR-10253-1 ..... N72-25258*
NASA-CASE-LAR-10270-1 ..... N72-25877*
NASA-CASE-LAR-10507-1 ..... N72-25284*
NASA-CASE-LAR-10513-1 ..... N72-25170*
NASA-CASE-LAR-10546-1 ..... N72-25287*
NASA-CASE-LAR-10612-1 ..... N72-25307*#
NASA-CASE-LAR-10620-1 ..... N72-25255*

NASA-CASE-LEW-10359 ..... N72-25911*
NASA-CASE-LEW-10424-2-2 ..... N72-25539*
NASA-CASE-LEW-10450-1 ..... N72-25448*
NASA-CASE-LEW-10489-1 ..... N72-25447*
NASA-CASE-LEW-10533-2 ..... N72-25479*#
NASA-CASE-LEW-10906-1 ..... N72-25164*#
NASA-CASE-LEW-10965-1 ..... N72-25452*

NASA-CASE-LEW-11348-1 ..... N72-25517*#
NASA-CASE-LEW-11387-1 ..... N72-25471*#
NASA-CASE-LEW-11390-1 ..... N72-25645*#
NASA-CASE-LEW-11632-1 ..... N72-25440*#

NASA-CASE-MFS-10354-2 ..... N72-25306*#
NASA-CASE-MFS-13994-2 ..... N72-25148*
NASA-CASE-MFS-15063 ..... N72-25412*
NASA-CASE-MFS-20207-1 ..... N72-25267*#
NASA-CASE-MFS-20332-2 ..... N72-25124*#
NASA-CASE-MFS-20434 ..... N72-25288*
NASA-CASE-MFS-20855-1 ..... N72-25853*#
NASA-CASE-MFS-20979 ..... N72-25151*
NASA-CASE-MFS-21010-1 ..... N72-25127*#
NASA-CASE-MFS-21042 ..... N72-25171*
NASA-CASE-MFS-21233-1 ..... N72-25627*#
NASA-CASE-MFS-21309-1 ..... N72-25480*#
NASA-CASE-MFS-21441-1 ..... N72-25427*#

NASA-CASE-MSC-10986-2 ..... N72-25489*#
NASA-CASE-MSC-12233-1 ..... N72-25454*
NASA-CASE-MSC-12372-1 ..... N72-25842*
NASA-CASE-MSC-12395 ..... N72-25257*
NASA-CASE-MSC-12397-1 ..... N72-25119*
NASA-CASE-MSC-13397-1 ..... N72-25595*
NASA-CASE-MSC-13609-1 ..... N72-25122*
NASA-CASE-MSC-13907-1 ..... N72-25281*#
NASA-CASE-MSC-13999-1 ..... N72-25142*#
NASA-CASE-MSC-15626-1 ..... N72-25411*
NASA-CASE-MSC-90153-2 ..... N72-25120*

NASA-CASE-NPO-10575 ..... N72-25019*
NASA-CASE-NPO-10606 ..... N72-25451*
NASA-CASE-NPO-10634 ..... N72-25619*
NASA-CASE-NPO-10636 ..... N72-25210*
NASA-CASE-NPO-10760 ..... N72-25254*
NASA-CASE-NPO-10863-2 ..... N72-25152*
NASA-CASE-NPO-11078 ..... N72-25262*
NASA-CASE-NPO-11095 ..... N72-25455*
NASA-CASE-NPO-11118 ..... N72-25021*
NASA-CASE-NPO-11161 ..... N72-25207*
NASA-CASE-NPO-11194 ..... N72-25209*
NASA-CASE-NPO-11202 ..... N72-25450*
NASA-CASE-NPO-11222 ..... N72-25456*
NASA-CASE-NPO-11264 ..... N72-25174*
NASA-CASE-NPO-11283 ..... N72-25260*
NASA-CASE-NPO-11311 ..... N72-25414*
NASA-CASE-NPO-11322 ..... N72-25146*
NASA-CASE-NPO-11338 ..... N72-25208*
NASA-CASE-NPO-11342 ..... N72-25248*
NASA-CASE-NPO-11358 ..... N72-25172*
NASA-CASE-NPO-11373 ..... N72-25323*
NASA-CASE-NPO-11556 ..... N72-25292*
NASA-CASE-NPO-11623-1 ..... N72-25628*#
NASA-CASE-NPO-11738-1 ..... N72-25269*#
NASA-CASE-NPO-11821-1 ..... N72-25222*#
NASA-CASE-NPO-11831 ..... N72-25222*#
NASA-CASE-NPO-11832 ..... N72-25222*#
NASA-CASE-NPO-11833 ..... N72-25222*#
NASA-CASE-NPO-11856-1 ..... N72-25490*#
NASA-CASE-NPO-12000 ..... N72-25699*

NASA-CASE-XER-07895 ..... N72-25679*

NASA-CASE-XLA-02609 ..... N72-25256*

NASA-CASE-XLE-6774-2 ..... N72-25150*

NASA-CASE-XMS-09690 ..... N72-25913*

NASA-CR-1981 ..... N72-25126*#
NASA-CR-1994 ..... N72-25024*#
NASA-CR-2003 ..... N72-24992*#
NASA-CR-2014 ..... N72-25125*#
NASA-CR-2016 ..... N72-24991*#
NASA-CR-2047 ..... N72-25546*#
NASA-CR-2061 ..... N72-25144*#
NASA-CR-2062 ..... N72-25336*#
NASA-CR-2066 ..... N72-25005*#
NASA-CR-2074 ..... N72-25548*#
NASA-CR-2080 ..... N72-25902*#
NASA-CR-61383 ..... N72-25305*#
NASA-CR-112048 ..... N72-25128*#
NASA-CR-112051 ..... N72-25623*#
NASA-CR-112055 ..... N72-25711*#
NASA-CR-112056 ..... N72-25712*#
NASA-CR-112058 ..... N72-25713*#
NASA-CR-112059 ..... N72-25714*#
NASA-CR-112060 ..... N72-25715*#

NASA-CR-112075 ..... N72-25547*#
NASA-CR-112085 ..... N72-25852*#
NASA-CR-112095 ..... N72-25631*#
NASA-CR-112639 ..... N72-25808*#
NASA-CR-114382 ..... N72-25133*#
NASA-CR-114426 ..... N72-25134*#
NASA-CR-114436 ..... N72-25599*#
NASA-CR-114465 ..... N72-25875*#
NASA-CR-115509 ..... N72-25743*#
NASA-CR-115554 ..... N72-25744*#
NASA-CR-115570 ..... N72-25754*#
NASA-CR-115597 ..... N72-25230*#
NASA-CR-115606 ..... N72-25231*#
NASA-CR-115607 ..... N72-25232*#
NASA-CR-115639 ..... N72-25343*#
NASA-CR-115640 ..... N72-25862*#
NASA-CR-115641 ..... N72-25061*#
NASA-CR-115654 ..... N72-25874*#
NASA-CR-115662 ..... N72-25867*#
NASA-CR-115663 ..... N72-25604*#
NASA-CR-115664 ..... N72-25143*#
NASA-CR-120019 ..... N72-25859*#
NASA-CR-120024 ..... N72-25863*#
NASA-CR-120033 ..... N72-25858*#
NASA-CR-120884 ..... N72-25158*#
NASA-CR-120892 ..... N72-25159*#
NASA-CR-122359 ..... N72-25726*#
NASA-CR-122360 ..... N72-25727*#
NASA-CR-122385 ..... N72-25710*#
NASA-CR-122394 ..... N72-25423*#
NASA-CR-122395 ..... N72-25180*#
NASA-CR-122402 ..... N72-25179*#
NASA-CR-122417 ..... N72-25194*#
NASA-CR-122418 ..... N72-25478*#
NASA-CR-122421 ..... N72-25640*#
NASA-CR-122425 ..... N72-25551*#
NASA-CR-122426 ..... N72-25270*#
NASA-CR-122427 ..... N72-25224*#
NASA-CR-123533 ..... N72-25214*#
NASA-CR-123559 ..... N72-25216*#
NASA-CR-123572 ..... N72-25542*#
NASA-CR-123580 ..... N72-25275*#
NASA-CR-123634 ..... N72-25215*#
NASA-CR-123635 ..... N72-25213*#
NASA-CR-123638 ..... N72-25700*#
NASA-CR-123639 ..... N72-25701*#
NASA-CR-123643 ..... N72-25418*#
NASA-CR-123644 ..... N72-25843*#
NASA-CR-123645 ..... N72-25844*#
NASA-CR-123646 ..... N72-25465*#
NASA-CR-123649 ..... N72-25464*#
NASA-CR-123652 ..... N72-25916*#
NASA-CR-123664 ..... N72-25705*#
NASA-CR-123666 ..... N72-25707*#
NASA-CR-123667 ..... N72-25706*#
NASA-CR-123671 ..... N72-25289*#
NASA-CR-123673 ..... N72-25708*#
NASA-CR-123674 ..... N72-25709*#
NASA-CR-123713 ..... N72-25836*#
NASA-CR-126561 ..... N72-25953*#
NASA-CR-126562 ..... N72-25954*#
NASA-CR-126574 ..... N72-25482*#
NASA-CR-126668 ..... N72-25217*#
NASA-CR-126718 ..... N72-25488*#
NASA-CR-126719 ..... N72-25029*#
NASA-CR-126720 ..... N72-25845*#
NASA-CR-126721 ..... N72-25334*#
NASA-CR-126722 ..... N72-25335*#
NASA-CR-126723 ..... N72-25742*#
NASA-CR-126724 ..... N72-25702*#
NASA-CR-126725 ..... N72-25329*#
NASA-CR-126726 ..... N72-25917*#
NASA-CR-126727 ..... N72-25153*#
NASA-CR-126728 ..... N72-25301*#
NASA-CR-126729 ..... N72-25639*#
NASA-CR-126738 ..... N72-25611*#
NASA-CR-126739 ..... N72-25915*#
NASA-CR-126741 ..... N72-25492*#
NASA-CR-126742 ..... N72-24995*#
NASA-CR-126743 ..... N72-25921*#
NASA-CR-126744 ..... N72-25102*#
NASA-CR-126746 ..... N72-25928*#
NASA-CR-126747 ..... N72-25486*#
NASA-CR-126748 ..... N72-25559*#
NASA-CR-126749 ..... N72-25219*#
NASA-CR-126751 ..... N72-25683*#
NASA-CR-126753 ..... N72-25624*#
NASA-CR-126767 ..... N72-25501*#
NASA-CR-126769 ..... N72-25558*#

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NASA-CR-126771 ..... N72-25682*#
NASA-CR-126772 ..... N72-25429*#
NASA-CR-126773 ..... N72-25101*#
NASA-CR-126786 ..... N72-25032*#
NASA-CR-126787 ..... N72-25347*#
NASA-CR-126846 ..... N72-25105*#
NASA-CR-126864 ..... N72-25609*#
NASA-CR-126865 ..... N72-25703*#
NASA-CR-126866 ..... N72-25668*#
NASA-CR-126867 ..... N72-25704*#
NASA-CR-126868 ..... N72-25610*#
NASA-CR-126869 ..... N72-25545*#
NASA-CR-126965 ..... N72-25925*#
NASA-CR-126966 ..... N72-25193*#
NASA-CR-126967 ..... N72-25309*#
NASA-CR-126968 ..... N72-25192*#
NASA-CR-126969 ..... N72-25026*#
NASA-CR-126970 ..... N72-25563*#
NASA-CR-126971 ..... N72-25276*#
NASA-CR-126972 ..... N72-25522*#
NASA-CR-126973 ..... N72-25688*#
NASA-CR-126985 ..... N72-25648*#
NASA-CR-127047 ..... N72-25191*#

NASA-SER-H-1008 ..... N72-25863*#

NASA-SER-S-0055 ..... N72-25858*#
NASA-SER-S-1036 ..... N72-25859*#

NASA-SP-262 ..... N72-25062*#
NASA-SP-267 ..... N72-25753*#
NASA-SP-295 ..... N72-25755*#
NASA-SP-300 ..... N72-25810*#
NASA-SP-5059 (01) ..... N72-25476*#
NASA-SP-5111 ..... N72-25470*#
NASA-SP-5926 (02) ..... N72-25421*#
NASA-SP-8095 ..... N72-25851*#

NASA-TM-X-2066 ..... N72-25424*#
NASA-TM-X-2562 ..... N72-25865*#
NASA-TM-X-2567 ..... N72-25955*#
NASA-TM-X-2575 ..... N72-25025*#
NASA-TM-X-2576 ..... N72-25523*#
NASA-TM-X-6509 ..... N72-25827*#
NASA-TM-X-53999 ..... N72-25693*#
NASA-TM-X-64648 ..... N72-25182*#
NASA-TM-X-64659 ..... N72-25474*#
NASA-TM-X-64662 ..... N72-25809*#
NASA-TM-X-64663 ..... N72-25308*#
NASA-TM-X-64668 ..... N72-25854*#
NASA-TM-X-65884 ..... N72-25344*#
NASA-TM-X-65885 ..... N72-25562*#
NASA-TM-X-65886 ..... N72-25860*#
NASA-TM-X-65887 ..... N72-25724*#
NASA-TM-X-65888 ..... N72-25561*#
NASA-TM-X-65890 ..... N72-25861*#
NASA-TM-X-65891 ..... N72-25341*#
NASA-TM-X-65893 ..... N72-25340*#
NASA-TM-X-65894 ..... N72-25828*#
NASA-TM-X-65895 ..... N72-25829*#
NASA-TM-X-65896 ..... N72-25830*#
NASA-TM-X-65897 ..... N72-25342*#
NASA-TM-X-65898 ..... N72-25647*#
NASA-TM-X-65899 ..... N72-25831*#
NASA-TM-X-65900 ..... N72-25339*#
NASA-TM-X-65901 ..... N72-25722*#
NASA-TM-X-65902 ..... N72-25832*#
NASA-TM-X-65903 ..... N72-25723*#
NASA-TM-X-65904 ..... N72-25630*#
NASA-TM-X-65905 ..... N72-25190*#
NASA-TM-X-65906 ..... N72-25601*#
NASA-TM-X-65907 ..... N72-25825*#
NASA-TM-X-65908 ..... N72-25826*#
NASA-TM-X-68052 ..... N72-25543*#
NASA-TM-X-68053 ..... N72-25544*#
NASA-TM-X-68054 ..... N72-25022*#
NASA-TM-X-68055 ..... N72-25023*#
NASA-TM-X-68322 ..... N72-25850*#
NASA-TM-X-68338 ..... N72-25649*#
NASA-TM-X-68339 ..... N72-25524*#
NASA-TM-X-68340 ..... N72-25866*#
NASA-TM-X-68341 ..... N72-25612*#
NASA-TM-X-68342 ..... N72-25846*#
NASA-TM-X-68350 ..... N72-25848*#
NASA-TM-X-68367 ..... N72-25872*#
NASA-TM-X-68368 ..... N72-25873*#
NASA-TM-X-68369 ..... N72-25961*#
NASA-TM-X-68370 ..... N72-25057*#

NASA-TM-X-68426 ..... N72-25183*#
NASA-TM-X-68824 ..... N72-25422*#
NASA-TM-X-68825 ..... N72-25181*#

NASA-TN-D-6668 ..... N72-25468*#
NASA-TN-D-6731 ..... N72-25277*#
NASA-TN-D-6756 ..... N72-25924*#
NASA-TN-D-6784 ..... N72-25904*#
NASA-TN-D-6833 ..... N72-24994*#
NASA-TN-D-6834 ..... N72-25646*#
NASA-TN-D-6836 ..... N72-25161*#
NASA-TN-D-6843 ..... N72-25923*#
NASA-TN-D-6844 ..... N72-25922*#
NASA-TN-D-6845 ..... N72-25856*#
NASA-TN-D-6846 ..... N72-25855*#
NASA-TN-D-6850 ..... N72-25903*#
NASA-TN-D-6851 ..... N72-25187*#
NASA-TN-D-6852 ..... N72-25186*#
NASA-TN-D-6853 ..... N72-25600*#
NASA-TN-D-6854 ..... N72-25857*#
NASA-TN-D-6855 ..... N72-25223*#
NASA-TN-D-6856 ..... N72-25100*#
NASA-TN-D-6857 ..... N72-25475*#
NASA-TN-D-6858 ..... N72-25099*#
NASA-TN-D-6863 ..... N72-25864*#
NASA-TN-D-6865 ..... N72-25290*#

NASA-TT-F-723 ..... N72-25582*#
NASA-TT-F-14190 ..... N72-25330*#
NASA-TT-F-14228 ..... N72-24990*#
NASA-TT-F-14243 ..... N72-25687*#
NASA-TT-F-14254 ..... N72-25303*#
NASA-TT-F-14260 ..... N72-25030*#
NASA-TT-F-14262 ..... N72-25425*#
NASA-TT-F-14267 ..... N72-25521*#
NASA-TT-F-14269 ..... N72-25752*#
NASA-TT-F-14272 ..... N72-25516*#
NASA-TT-F-14279 ..... N72-25345*#
NASA-TT-F-14283 ..... N72-24993*#

NAVMED-MF12.524.004-9010D ..... N72-25113 #
NAVMED-MF12.524.004-9015D ..... N72-25114 #
NAVMED-MF12.524.005-7015BX8X-1 ..... N72-25118 #

NAVMED-MR005.01.01-0130BOLL-01 ..... N72-25115 #

NBS-SP-362 ..... N72-25160 #

NBS-TN-723 ..... N72-25487 #
NBS-TN-725 ..... N72-25227 #

NBS-10735 ..... N72-25423*#

NOAA-TM-ERL-BOMAP-9 ..... N72-25333 #

NOAA-TM-NESS-29 ..... N72-25721 #

NOAA-TM-NWS-TDL-45 ..... N72-25581 #

NOAA-TR-NESS-55 ..... N72-25583 #

NOLTR-72-34 ..... N72-24995*#

NOTA-INTERNA-349 ..... N72-25662 #
NOTA-INTERNA-352 ..... N72-25637 #
NOTA-INTERNA-354 ..... N72-25663 #
NOTA-INTERNA-357 ..... N72-25664 #
NOTA-INTERNA-358 ..... N72-25638 #
NOTA-INTERNA-360 ..... N72-25665 #

NP-19177 ..... N72-25198 #
NP-19199 ..... N72-25614 #

NPL-DCS-14 ..... N72-25167 #
NPL-DCS-15 ..... N72-25697 #

NPL-NAC-10 ..... N72-25245 #
NPL-NAC-14 ..... N72-25244 #

NRC-TT-1544 ..... N72-25166 #
NRC-TT-1550 ..... N72-25027 #

NRC-12624 ..... N72-25900 #

NSF-71-35-VOL-20 ..... N72-25956 #

NSMRL-MR-71-4 ..... N72-25113 #

NSMRL-664 ..... N72-25114 #

NSMRL-669 ..... N72-25115 #

NSRDS-NBS-40 ..... N72-25807 #

NTSB-AAR-72-4 ..... N72-25013 #
NTSB-AAR-72-11 ..... N72-25006 #

NTSB-ARG-71-1 ..... N72-25004 #

NUB-2126 ..... N72-25629 #

ONERA-DERTS-NT-02-29 ..... N72-25553 #
ONERA-DERTS-NT-03-8 ..... N72-25554 #

ONERA-NT-187 ..... N72-25636 #

ORNL-EIS-72-18-VOL-1 ..... N72-25635 #
ORNL-EIS-72-18-VOL-2 ..... N72-25658 #

ORNL-TM-3396 ..... N72-25660 #

ORO-3778-5 ..... N72-25615 #
ORO-4049-2 ..... N72-25659 #

P-4479 ..... N72-25560 #
P-4728 ..... N72-25221 #
P-4772-1 ..... N72-25332 #

PAPER-54-71/SC122-3 ..... N72-25602 #

PB-202085-F ..... N72-25866*#
PB-206688 ..... N72-25205 #
PB-206912 ..... N72-25322 #
PB-206948 ..... N72-25401 #
PB-206950 ..... N72-25510 #
PB-207101 ..... N72-25013 #
PB-207107 ..... N72-25589 #
PB-207321 ..... N72-25593 #

PL-480-12 ..... N72-25718 #

PPG-113 ..... N72-25640*#

PR-8 ..... N72-25224*#

PUBL-893 ..... N72-25847 #

PWA-4339 ..... N72-25593 #

PX-6676-VOL-1 ..... N72-25213*#
PX-6676-VOL-2 ..... N72-25214*#
PX-6676-VOL-3 ..... N72-25215*#

QPR-3-5865 ..... N72-25702*#
QPR-18 ..... N72-25671 #
QPR-104 ..... N72-25840 #

QR-3-PT-3 ..... N72-25577

R-550 ..... N72-25698 #
R-693 ..... N72-25604*#
R-918 ..... N72-25935 #
R-8962 ..... N72-25418*#

RAC-TP-439 ..... N72-25991 #

RADC-TR-71-306 ..... N72-25202 #
RADC-TR-72-21 ..... N72-25203 #

RAE-LIB-TRANS-1525 ..... N72-25525 #
RAE-LIB-TRANS-1608 ..... N72-25165 #
RAE-LIB-TRANS-1621 ..... N72-25441 #
RAE-LIB-TRANS-1627 ..... N72-25302 #

RAE-TR-70240 ..... N72-24998 #
RAE-TR-71088 ..... N72-25273 #
RAE-TR-71145 ..... N72-25607 #
RAE-TR-71186 ..... N72-25606 #
RAE-TR-71202 ..... N72-25838 #

RE-427J ..... N72-25304 #

REPT-5 ..... N72-25331 #
REPT-13 ..... N72-25917*#
REPT-16 ..... N72-25897
REPT-18 ..... N72-25557
REPT-32 ..... N72-25918 #
REPT-43 ..... N72-25881
REPT-44 ..... N72-25299

REPT-60 ..... N72-25880
REPT-63 ..... N72-25885
REPT-64 ..... N72-25459
REPT-66 ..... N72-25886
REPT-67 ..... N72-25887
REPT-71-7300-2-VOL-2 ..... N72-25024*#
REPT-72-0012-VOL-1 ..... N72-25216*#
REPT-72-0012-VOL-2 ..... N72-25217*#
REPT-79 ..... N72-25888
REPT-80 ..... N72-25889
REPT-82 ..... N72-25556
REPT-86-185A-APP-3-BK-1 ..... N72-25230*#
REPT-86-185B-APP-3-BK-2 ..... N72-25232*#
REPT-88 ..... N72-25896
REPT-92 ..... N72-25515
REPT-93 ..... N72-25514
REPT-94 ..... N72-25300
REPT-98 ..... N72-25750 #
REPT-101 ..... N72-25749 #
REPT-102 ..... N72-25890
REPT-105 ..... N72-25882
REPT-106 ..... N72-25884
REPT-107 ..... N72-25883
REPT-108 ..... N72-25681
REPT-108.118/1 ..... N72-25633 #
REPT-109 ..... N72-25894
REPT-110 ..... N72-25895
REPT-211B00862 ..... N72-25744*#
REPT-272 ..... N72-24990*#
REPT-327 ..... N72-25388*#
REPT-496 ..... N72-25550 #
REPT-498 ..... N72-25549 #
REPT-605 ..... N72-25289*#
REPT-779/72/1-VOL-1 ..... N72-25445 #
REPT-779/72/1-VOL-2-SUMM ..... N72-25446 #
REPT-1000.27-APP-1 ..... N72-25949 #
REPT-1000.27-APP-2 ..... N72-25950 #
REPT-1245 ..... N72-25387*#
REPT-4040-F ..... N72-25710*#
REPT-7009.453 ..... N72-25467 +
REPT-7105.510 ..... N72-25449 +
REPT-7107.521 ..... N72-25625 +
REPT-7110.541 ..... N72-25466 +
REPT-8107-F ..... N72-25202 #
REPT-9755-72-3 ..... N72-25701*#
REPT-9755-72-5 ..... N72-25700*#
REPT-86185F-APP-2 ..... N72-25231*#
REPT-043810-F ..... N72-25683*#

RM-71-001 ..... N72-25486*#
RM-540 ..... N72-25906 #
RM-544 ..... N72-25532 #
RM-545 ..... N72-25481 #

RR-96 ..... N72-25748 #
RR-102 ..... N72-25220 #
RR-104 ..... N72-25598 #

RSC-756-1 ..... N72-25405 #

RSD-66 ..... N72-25331 #
RSD-67 ..... N72-25719 #
RSD-68 ..... N72-25718 #

RVO-A70/KM/116 ..... N72-25633 #

S-DOC-92-57 ..... N72-25951 #

S-REPT-92-333 ..... N72-25947 #
S-REPT-92-503 ..... N72-25948 #
S-REPT-92-779 ..... N72-25933 #

S-71-1130 ..... N72-25028 #

SAMSO-TR-124-VOL-5-PT-B ..... N72-25246 #

SATR-1 ..... N72-25203 #
SATR-4 ..... N72-25169 #
SATR-8 ..... N72-25808*#

SD-72-SH-0015 ..... N72-25542*#

SE-019-008-2H-A-VOL-1 ..... N72-25705*#
SE-019-008-2H-B-VOL-2 ..... N72-25706*#
SE-019-008-2H-C-VOL-3-PT-1 ..... N72-25707*#
SE-019-008-2H-C-VOL-3-PT-2 ..... N72-25708*#
SE-019-011-2H ..... N72-25709*#

SIT-P268 ..... N72-25682*#

SMU-80-34 ..... N72-25404 #

SN-1 ..... N72-25728 #
SN-230-VOL-2 ..... N72-25301*#

SR-3 ..... N72-25199 #
SR-4 ..... N72-25403 #
SR-66 ..... N72-25331 #
SR-68 ..... N72-25718 #

STDN-502.10-REV-1 ..... N72-25181*#

SUPPL-5 ..... N72-25846*#

SVHSER-5851 ..... N72-25126*#

TB-88 ..... N72-25002

TDCK-58256 ..... N72-25849 #
TDCK-58326 ..... N72-25898 #
TDCK-58813 ..... N72-25633 #
TDCK-59099 ..... N72-25919 #
TDCK-059100 ..... N72-25920 #
TDCK-059204 ..... N72-25264 #

TI-415-71-1 ..... N72-25110 #

TID-25864 ..... N72-25694 #
TID-25901 ..... N72-25616 #
TID-25912 ..... N72-25672 #
TID-25940 ..... N72-25617 #

TL-1971-7 ..... N72-25849 #
TL-1971-11 ..... N72-25898 #
TL-1971-16 ..... N72-25919 #
TL-1971-17 ..... N72-25920 #

TN-1 ..... N72-25891
TN-4 ..... N72-25892
TN-7 ..... N72-25893
TN-10 ..... N72-25512
TN-11 ..... N72-25905 #
TN-12 ..... N72-25513
TN-34 ..... N72-25571 #
TN-174 ..... N72-25278 #
TN-1972-14-PT-1 ..... N72-25201 #

TOP-9-3-313 ..... N72-25484 #

TOPR-178-1-121 ..... N72-25154 #

TPD-1971-0-2 ..... N72-25264 #

TR-7 ..... N72-25008 #
TR-184 ..... N72-25188 #
TR-489 ..... N72-25200 #
TR-2374-7 ..... N72-25180*#
TR-6105.506 ..... N72-25462
TR-7103.494 ..... N72-25463
TR-7105.512 ..... N72-25461
TR-7108.533 ..... N72-25458
TR-7111.549 ..... N72-25621
TR-7201.561 ..... N72-25620
TR-7202.564 ..... N72-25622
TR-7202.568 ..... N72-25460

TRC-BR-27989 ..... N72-25319 #

TRITA-EPP-71-14 ..... N72-25395 #
TRITA-EPP-71-26 ..... N72-25674 #
TRITA-EPP-72-07 ..... N72-25395 #

TRW-16568-6014-R000 ..... N72-25845*#

TR70-148 ..... N72-25343*#
TR72-12 ..... N72-25105*#

TT-70-50155 ..... N72-25641 #

T141RP007 ..... N72-25133*#

U-4995 ..... N72-25169 #

UARL-K911106-4 ..... N72-25488*#

UCRL-51169 ..... N72-25443 #

UILU-ENG-72-2209 ..... N72-25698 #

UILU-ENG-72-2501 ..... N72-25337 #
UILU-ENG-72-2502 ..... N72-25329*#

UNICH-03371-13-T ..... N72-25322 #

UNICP-SR83-VOL-2-PT-C ..... N72-25676 #

US-PATENT-APPL-SN-5114 ..... N72-25150*
US-PATENT-APPL-SN-6615 ..... N72-25019*
US-PATENT-APPL-SN-8636 ..... N72-25451*
US-PATENT-APPL-SN-8650 ..... N72-25021*
US-PATENT-APPL-SN-10329 ..... N72-25251*
US-PATENT-APPL-SN-15222 ..... N72-25539*
US-PATENT-APPL-SN-19585 ..... N72-25455*
US-PATENT-APPL-SN-25488 ..... N72-25206*
US-PATENT-APPL-SN-32664 ..... N72-25287*
US-PATENT-APPL-SN-36531 ..... N72-25174*
US-PATENT-APPL-SN-39185 ..... N72-25485*
US-PATENT-APPL-SN-39342 ..... N72-25252*
US-PATENT-APPL-SN-39344 ..... N72-25409*
US-PATENT-APPL-SN-41347 ..... N72-25256*
US-PATENT-APPL-SN-43884 ..... N72-25457*
US-PATENT-APPL-SN-45519 ..... N72-25410*
US-PATENT-APPL-SN-47061 ..... N72-25680*
US-PATENT-APPL-SN-47063 ..... N72-25911*
US-PATENT-APPL-SN-51477 ..... N72-25412*
US-PATENT-APPL-SN-54270 ..... N72-25173*
US-PATENT-APPL-SN-55534 ..... N72-25288*
US-PATENT-APPL-SN-55537 ..... N72-25540*
US-PATENT-APPL-SN-57252 ..... N72-25414*
US-PATENT-APPL-SN-57253 ..... N72-25541*
US-PATENT-APPL-SN-59893 ..... N72-25456*
US-PATENT-APPL-SN-59966 ..... N72-25595*
US-PATENT-APPL-SN-59969 ..... N72-25249*
US-PATENT-APPL-SN-60881 ..... N72-25877*
US-PATENT-APPL-SN-61535 ..... N72-25453*
US-PATENT-APPL-SN-63532 ..... N72-25209*
US-PATENT-APPL-SN-63610 ..... N72-25147*
US-PATENT-APPL-SN-64391 ..... N72-25842*
US-PATENT-APPL-SN-64723 ..... N72-25170*
US-PATENT-APPL-SN-66004 ..... N72-25450*
US-PATENT-APPL-SN-73310 ..... N72-25247*
US-PATENT-APPL-SN-73422 ..... N72-25454*
US-PATENT-APPL-SN-74861 ..... N72-25699*
US-PATENT-APPL-SN-77221 ..... N72-25210*
US-PATENT-APPL-SN-78704 ..... N72-25121*
US-PATENT-APPL-SN-81095 ..... N72-25323*
US-PATENT-APPL-SN-82280 ..... N72-25262*
US-PATENT-APPL-SN-82648 ..... N72-25292*
US-PATENT-APPL-SN-86417 ..... N72-25171*
US-PATENT-APPL-SN-87550 ..... N72-25146*
US-PATENT-APPL-SN-89209 ..... N72-25248*
US-PATENT-APPL-SN-89212 ..... N72-25208*
US-PATENT-APPL-SN-94347 ..... N72-25122*
US-PATENT-APPL-SN-94374 ..... N72-25411*
US-PATENT-APPL-SN-98517 ..... N72-25250*
US-PATENT-APPL-SN-98640 ..... N72-25253*
US-PATENT-APPL-SN-99175 ..... N72-25258*
US-PATENT-APPL-SN-100774 ..... N72-25151*
US-PATENT-APPL-SN-112999 ..... N72-25619*
US-PATENT-APPL-SN-116786 ..... N72-25172*
US-PATENT-APPL-SN-118270 ..... N72-25260*
US-PATENT-APPL-SN-125979 ..... N72-25255*
US-PATENT-APPL-SN-129071 ..... N72-25254*
US-PATENT-APPL-SN-134573 ..... N72-25257*
US-PATENT-APPL-SN-139528 ..... N72-25020*
US-PATENT-APPL-SN-145026 ..... N72-25152*
US-PATENT-APPL-SN-195061 ..... N72-25124*#
US-PATENT-APPL-SN-215076 ..... N72-25489*#
US-PATENT-APPL-SN-231662 ..... N72-25427*#
US-PATENT-APPL-SN-233173 ..... N72-25307*#
US-PATENT-APPL-SN-235268 ..... N72-25490*#
US-PATENT-APPL-SN-235295 ..... N72-25269*#
US-PATENT-APPL-SN-235338 ..... N72-25628*#
US-PATENT-APPL-SN-235962 ..... N72-25491*#
US-PATENT-APPL-SN-236052 ..... N72-25428*#
US-PATENT-APPL-SN-236285 ..... N72-25222*#
US-PATENT-APPL-SN-239574 ..... N72-25267*#
US-PATENT-APPL-SN-241615 ..... N72-25268*#
US-PATENT-APPL-SN-243374 ..... N72-25853*#
US-PATENT-APPL-SN-244519 ..... N72-25480*#
US-PATENT-APPL-SN-244523 ..... N72-25871*#
US-PATENT-APPL-SN-246056 ..... N72-25627*#
US-PATENT-APPL-SN-247055 ..... N72-25479*#
US-PATENT-APPL-SN-247090 ..... N72-25471*#
US-PATENT-APPL-SN-247434 ..... N72-25645*#
US-PATENT-APPL-SN-247481 ..... N72-25129*#
US-PATENT-APPL-SN-247482 ..... N72-25517*#
US-PATENT-APPL-SN-250335 ..... N72-25306*#
US-PATENT-APPL-SN-250766 ..... N72-25184*#
US-PATENT-APPL-SN-251609 ..... N72-25127*#
US-PATENT-APPL-SN-253405 ..... N72-25280*#
US-PATENT-APPL-SN-254173 ..... N72-25440*#
US-PATENT-APPL-SN-254177 ..... N72-25281*#
US-PATENT-APPL-SN-254279 ..... N72-25164*#
US-PATENT-APPL-SN-256317 ..... N72-25142*#
US-PATENT-APPL-SN-651627 ..... N72-25679*
US-PATENT-APPL-SN-785613 ..... N72-25119*
US-PATENT-APPL-SN-822039 ..... N72-25149*
US-PATENT-APPL-SN-844225 ..... N72-25120*
US-PATENT-APPL-SN-853641 ..... N72-25913*
US-PATENT-APPL-SN-868775 ..... N72-25261*
US-PATENT-APPL-SN-870689 ..... N72-25148*
US-PATENT-APPL-SN-874177 ..... N72-25284*
US-PATENT-APPL-SN-876588 ..... N72-25452*
US-PATENT-APPL-SN-880271 ..... N72-25448*
US-PATENT-APPL-SN-882123 ..... N72-25211*
US-PATENT-APPL-SN-889374 ..... N72-25207*
US-PATENT-APPL-SN-889420 ..... N72-25413*
US-PATENT-APPL-SN-889422 ..... N72-25259*
US-PATENT-APPL-SN-889682 ..... N72-25447*

US-PATENT-CLASS-2-2.1 ..... N72-25119*
US-PATENT-CLASS-2-115 ..... N72-25119*
US-PATENT-CLASS-29-25.14 ..... N72-25121*
US-PATENT-CLASS-29-25.18 ..... N72-25121*
US-PATENT-CLASS-29-198 ..... N72-25259*
US-PATENT-CLASS-29-482 ..... N72-25121*
US-PATENT-CLASS-29-492 ..... N72-25261*
US-PATENT-CLASS-29-497 ..... N72-25261*
US-PATENT-CLASS-29-498 ..... N72-25261*
US-PATENT-CLASS-29-502 ..... N72-25261*
US-PATENT-CLASS-29-589 ..... N72-25261*
US-PATENT-CLASS-29-599 ..... N72-25447*
US-PATENT-CLASS-29-628 ..... N72-25261*
US-PATENT-CLASS-29-630A N72-25121*
US-PATENT-CLASS-52-DIG.10 ..... N72-25540*
US-PATENT-CLASS-52-DIG.10 ..... N72-25541*
US-PATENT-CLASS-52-80 ..... N72-25540*
US-PATENT-CLASS-52-80 ..... N72-25541*
US-PATENT-CLASS-52-169 ..... N72-25454*
US-PATENT-CLASS-52-173 ..... N72-25454*
US-PATENT-CLASS-52-594 ..... N72-25454*
US-PATENT-CLASS-52-648 ..... N72-25287*
US-PATENT-CLASS-52-655 ..... N72-25287*
US-PATENT-CLASS-60-39.74A N72-25455*
US-PATENT-CLASS-60-200A N72-25911*
US-PATENT-CLASS-60-258 ..... N72-25455*
US-PATENT-CLASS-60-265 ..... N72-25911*
US-PATENT-CLASS-60-267 ..... N72-25911*
US-PATENT-CLASS-62-6 ..... N72-25619*
US-PATENT-CLASS-62-80 ..... N72-25619*
US-PATENT-CLASS-62-85 ..... N72-25619*
US-PATENT-CLASS-62-467 ..... N72-25911*
US-PATENT-CLASS-62-475 ..... N72-25619*
US-PATENT-CLASS-73-12 ..... N72-25411*
US-PATENT-CLASS-73-15.6 ..... N72-25877*
US-PATENT-CLASS-73-15R N72-25913*
US-PATENT-CLASS-73-23.1 ..... N72-25146*
US-PATENT-CLASS-73-100 ..... N72-25877*
US-PATENT-CLASS-73-140 ..... N72-25288*
US-PATENT-CLASS-73-161 ..... N72-25288*
US-PATENT-CLASS-73-421.5R N72-25323*
US-PATENT-CLASS-73-422GC N72-25323*
US-PATENT-CLASS-73-422TC N72-25323*
US-PATENT-CLASS-73-492 ..... N72-25411*
US-PATENT-CLASS-73-515 ..... N72-25410*
US-PATENT-CLASS-73-521 ..... N72-25410*
US-PATENT-CLASS-75-DIG.1 ..... N72-25539*
US-PATENT-CLASS-75-206 ..... N72-25448*
US-PATENT-CLASS-75-208 ..... N72-25539*
US-PATENT-CLASS-75-211 ..... N72-25539*
US-PATENT-CLASS-75-213 ..... N72-25448*
US-PATENT-CLASS-75-226 ..... N72-25539*
US-PATENT-CLASS-75/0.5BB N72-25448*
US-PATENT-CLASS-95-12.5 ..... N72-25842*
US-PATENT-CLASS-96-36.2 ..... N72-25452*
US-PATENT-CLASS-102-34.4 ..... N72-25171*
US-PATENT-CLASS-102-105 ..... N72-25911*
US-PATENT-CLASS-106-209 ..... N72-25120*
US-PATENT-CLASS-116-114AH N72-25411*
US-PATENT-CLASS-117-16R N72-25452*
US-PATENT-CLASS-117-37 ..... N72-25452*
US-PATENT-CLASS-117-47R N72-25452*
US-PATENT-CLASS-117-62 ..... N72-25447*
US-PATENT-CLASS-117-62 ..... N72-25452*
US-PATENT-CLASS-117-93.3 ..... N72-25452*
US-PATENT-CLASS-117-93.16D N72-25447*

US-PATENT-CLASS-117-107 ..... N72-25447*
US-PATENT-CLASS-117-124 ..... N72-25452*
US-PATENT-CLASS-117-132 ..... N72-25150*
US-PATENT-CLASS-117-152 ..... N72-25452*
US-PATENT-CLASS-117-161 ..... N72-25150*
US-PATENT-CLASS-117-200 ..... N72-25259*
US-PATENT-CLASS-117-211 ..... N72-25447*
US-PATENT-CLASS-117-217 ..... N72-25447*
US-PATENT-CLASS-128-2.1 ..... N72-25120*
US-PATENT-CLASS-128-2N N72-25122*
US-PATENT-CLASS-128-417 ..... N72-25120*
US-PATENT-CLASS-136-89 ..... N72-25259*
US-PATENT-CLASS-149-19 ..... N72-25699*
US-PATENT-CLASS-149-20 ..... N72-25699*
US-PATENT-CLASS-149-36 ..... N72-25699*
US-PATENT-CLASS-149-92 ..... N72-25699*
US-PATENT-CLASS-156-250 ..... N72-25019*
US-PATENT-CLASS-156-264 ..... N72-25121*
US-PATENT-CLASS-156-308 ..... N72-25121*
US-PATENT-CLASS-156-510 ..... N72-25019*
US-PATENT-CLASS-161-7 ..... N72-25540*
US-PATENT-CLASS-161-7 ..... N72-25541*
US-PATENT-CLASS-161-68 ..... N72-25540*
US-PATENT-CLASS-161-68 ..... N72-25541*
US-PATENT-CLASS-161-127 ..... N72-25540*
US-PATENT-CLASS-161-127 ..... N72-25541*
US-PATENT-CLASS-178-DIG.8 ..... N72-25412*
US-PATENT-CLASS-178-6.8 ..... N72-25412*
US-PATENT-CLASS-178-7.92 ..... N72-25414*
US-PATENT-CLASS-178-50 ..... N72-25208*
US-PATENT-CLASS-178-69.5 ..... N72-25173*
US-PATENT-CLASS-179-15BC N72-25208*
US-PATENT-CLASS-179-15BV N72-25172*
US-PATENT-CLASS-179-15FD N72-25208*
US-PATENT-CLASS-187-1 ..... N72-25453*
US-PATENT-CLASS-187-20 ..... N72-25453*
US-PATENT-CLASS-195-28N N72-25149*
US-PATENT-CLASS-195-103.5R N72-25149*
US-PATENT-CLASS-195-127 ..... N72-25284*
US-PATENT-CLASS-195-127 ..... N72-25413*
US-PATENT-CLASS-204-49 ..... N72-25452*
US-PATENT-CLASS-204-157.18AG N72-25452*
US-PATENT-CLASS-210-188 ..... N72-25292*
US-PATENT-CLASS-214-90R N72-25021*
US-PATENT-CLASS-235-92T N72-25020*
US-PATENT-CLASS-235-152 ..... N72-25210*
US-PATENT-CLASS-235-154 ..... N72-25206*
US-PATENT-CLASS-239-424 ..... N72-25455*
US-PATENT-CLASS-244-1SA N72-25595*
US-PATENT-CLASS-244-23A N72-25595*
US-PATENT-CLASS-250-43.5R N72-25146*
US-PATENT-CLASS-250-65F N72-25452*
US-PATENT-CLASS-250-83.3UV N72-25409*
US-PATENT-CLASS-250-209 ..... N72-25409*
US-PATENT-CLASS-250-226 ..... N72-25409*
US-PATENT-CLASS-251-360 ..... N72-25451*
US-PATENT-CLASS-252-514 ..... N72-25120*
US-PATENT-CLASS-254-190 ..... N72-25453*
US-PATENT-CLASS-260-2.5 ..... N72-25150*
US-PATENT-CLASS-260-2.5FP N72-25147*
US-PATENT-CLASS-260-18S N72-25151*
US-PATENT-CLASS-260-46.5E N72-25151*
US-PATENT-CLASS-260-46.5G N72-25151*
US-PATENT-CLASS-260-46.5P N72-25151*
US-PATENT-CLASS-260-92.1 ..... N72-25150*
US-PATENT-CLASS-260-92.1 ..... N72-25152*
US-PATENT-CLASS-260-211.5 ..... N72-25149*
US-PATENT-CLASS-260-348SC N72-25148*
US-PATENT-CLASS-260-448.2D N72-25151*
US-PATENT-CLASS-264-104 ..... N72-25120*
US-PATENT-CLASS-285-DIG.21 ..... N72-25450*
US-PATENT-CLASS-285-3 ..... N72-25450*
US-PATENT-CLASS-285-33 ..... N72-25450*
US-PATENT-CLASS-285-316 ..... N72-25450*
US-PATENT-CLASS-287-54A N72-25287*
US-PATENT-CLASS-307-83 ..... N72-25262*
US-PATENT-CLASS-307-88.3 ..... N72-25258*
US-PATENT-CLASS-307-103 ..... N72-25262*
US-PATENT-CLASS-307-141.8 ..... N72-25020*
US-PATENT-CLASS-307-233 ..... N72-25257*
US-PATENT-CLASS-307-261 ..... N72-25251*
US-PATENT-CLASS-310-4 ..... N72-25260*
US-PATENT-CLASS-310-10 ..... N72-25255*
US-PATENT-CLASS-310-11 ..... N72-25292*
US-PATENT-CLASS-310-15 ..... N72-25255*
US-PATENT-CLASS-310-68 ..... N72-25456*
US-PATENT-CLASS-310-80 ..... N72-25456*
US-PATENT-CLASS-310-83 ..... N72-25456*
US-PATENT-CLASS-315-135 ..... N72-25250*
US-PATENT-CLASS-315-349 ..... N72-25250*
US-PATENT-CLASS-317-234J N72-25679*
US-PATENT-CLASS-317-235A N72-25679*
US-PATENT-CLASS-317-235AJ N72-25679*
US-PATENT-CLASS-317-235R N72-25679*
US-PATENT-CLASS-320-48 ..... N72-25020*
US-PATENT-CLASS-321-2 ..... N72-25249*
US-PATENT-CLASS-321-2 ..... N72-25251*
US-PATENT-CLASS-321-2 ..... N72-25252*
US-PATENT-CLASS-321-2 ..... N72-25253*
US-PATENT-CLASS-321-2 ..... N72-25254*
US-PATENT-CLASS-321-11 ..... N72-25252*
US-PATENT-CLASS-321-18 ..... N72-25251*
US-PATENT-CLASS-321-18 ..... N72-25252*
US-PATENT-CLASS-321-19 ..... N72-25252*
US-PATENT-CLASS-321-45ER N72-25252*
US-PATENT-CLASS-321-45R N72-25252*
US-PATENT-CLASS-321-45R N72-25254*
US-PATENT-CLASS-321-47 ..... N72-25253*
US-PATENT-CLASS-323-DIG.1 ..... N72-25249*
US-PATENT-CLASS-323-17 ..... N72-25249*
US-PATENT-CLASS-323-22T N72-25249*
US-PATENT-CLASS-323-48 ..... N72-25262*
US-PATENT-CLASS-323-82 ..... N72-25262*
US-PATENT-CLASS-324-29.5 ..... N72-25020*
US-PATENT-CLASS-324-51 ..... N72-25211*
US-PATENT-CLASS-324-73 ..... N72-25211*
US-PATENT-CLASS-324-78D N72-25257*
US-PATENT-CLASS-324-92 ..... N72-25680*
US-PATENT-CLASS-324-96 ..... N72-25680*
US-PATENT-CLASS-324-158D N72-25457*
US-PATENT-CLASS-324-158T N72-25457*
US-PATENT-CLASS-324-186 ..... N72-25257*
US-PATENT-CLASS-325-4 ..... N72-25171*
US-PATENT-CLASS-325-38 ..... N72-25173*
US-PATENT-CLASS-325-51 ..... N72-25173*
US-PATENT-CLASS-325-55 ..... N72-25173*
US-PATENT-CLASS-325-58 ..... N72-25173*
US-PATENT-CLASS-325-62 ..... N72-25208*
US-PATENT-CLASS-325-64 ..... N72-25173*
US-PATENT-CLASS-325-114 ..... N72-25171*
US-PATENT-CLASS-325-141 ..... N72-25173*
US-PATENT-CLASS-325-302 ..... N72-25173*
US-PATENT-CLASS-325-325 ..... N72-25173*
US-PATENT-CLASS-328-136 ..... N72-25257*
US-PATENT-CLASS-328-140 ..... N72-25257*
US-PATENT-CLASS-330-2 ..... N72-25250*
US-PATENT-CLASS-330-4.5 ..... N72-25258*
US-PATENT-CLASS-330-59 ..... N72-25250*
US-PATENT-CLASS-331-94.5 ..... N72-25485*
US-PATENT-CLASS-331-107G N72-25679*
US-PATENT-CLASS-331-113A N72-25253*
US-PATENT-CLASS-331-113A N72-25254*
US-PATENT-CLASS-332-7.51 ..... N72-25485*
US-PATENT-CLASS-332-21 ..... N72-25208*
US-PATENT-CLASS-333-7 ..... N72-25170*
US-PATENT-CLASS-333-79 ..... N72-25256*
US-PATENT-CLASS-333-81R N72-25170*
US-PATENT-CLASS-333-98P N72-25170*
US-PATENT-CLASS-333-98R N72-25170*
US-PATENT-CLASS-333-98S N72-25170*
US-PATENT-CLASS-339-45M N72-25450*
US-PATENT-CLASS-339-91B N72-25450*
US-PATENT-CLASS-339-143R N72-25256*
US-PATENT-CLASS-339-147R N72-25256*
US-PATENT-CLASS-340-146.1 ..... N72-25207*
US-PATENT-CLASS-340-146.1AL N72-25210*
US-PATENT-CLASS-340-167 ..... N72-25173*
US-PATENT-CLASS-340-172.5 ..... N72-25207*
US-PATENT-CLASS-340-172.5 ..... N72-25248*
US-PATENT-CLASS-340-172-5 ..... N72-25172*
US-PATENT-CLASS-340-227R N72-25412*
US-PATENT-CLASS-340-324A N72-25248*
US-PATENT-CLASS-340-324R N72-25680*
US-PATENT-CLASS-340-332 ..... N72-25250*
US-PATENT-CLASS-340-347DA N72-25206*
US-PATENT-CLASS-340-413 ..... N72-25211*
US-PATENT-CLASS-343-6.5R N72-25171*
US-PATENT-CLASS-343-6.5R N72-25209*
US-PATENT-CLASS-343-12R N72-25209*
US-PATENT-CLASS-343-14 ..... N72-25209*
US-PATENT-CLASS-343-708 ..... N72-25247*
US-PATENT-CLASS-343-762 ..... N72-25174*
US-PATENT-CLASS-343-771 ..... N72-25247*
US-PATENT-CLASS-343-777 ..... N72-25174*
US-PATENT-CLASS-343-779 ..... N72-25174*
US-PATENT-CLASS-343-786 ..... N72-25174*
US-PATENT-CLASS-343-853 ..... N72-25174*
US-PATENT-CLASS-343-873 ..... N72-25247*

US-PATENT-CLASS-350-150 ..... N72-25680*
US-PATENT-CLASS-350-160R N72-25410*
US-PATENT-CLASS-350-160R N72-25680*
US-PATENT-CLASS-350-175FS N72-25414*
US-PATENT-CLASS-350-203 ..... N72-25409*

US-PATENT-3,621,372 ..... N72-25249*
US-PATENT-3,648,083 ..... N72-25292*
US-PATENT-3,648,250 ..... N72-25248*
US-PATENT-3,648,256 ..... N72-25207*
US-PATENT-3,648,275 ..... N72-25206*
US-PATENT-3,649,242 ..... N72-25448*
US-PATENT-3,649,356 ..... N72-25447*
US-PATENT-3,649,462 ..... N72-25284*
US-PATENT-3,649,935 ..... N72-25170*
US-PATENT-3,653,052 ..... N72-25247*
US-PATENT-3,653,882 ..... N72-25539*
US-PATENT-3,654,036 ..... N72-25019*
US-PATENT-3,656,313 ..... N72-25619*
US-PATENT-3,656,317 ..... N72-25911*
US-PATENT-3,656,352 ..... N72-25411*
US-PATENT-3,656,781 ..... N72-25450*
US-PATENT-3,657,549 ..... N72-25409*
US-PATENT-3,657,928 ..... N72-25410*
US-PATENT-3,658,295 ..... N72-25451*
US-PATENT-3,658,569 ..... N72-25452*
US-PATENT-3,658,608 ..... N72-25699*
US-PATENT-3,659,043 ..... N72-25412*
US-PATENT-3,659,053 ..... N72-25208*
US-PATENT-3,659,148 ..... N72-25250*
US-PATENT-3,659,184 ..... N72-25251*
US-PATENT-3,659,225 ..... N72-25485*
US-PATENT-3,659,292 ..... N72-25209*
US-PATENT-3,660-704 ..... N72-25456*
US-PATENT-3,660,240 ..... N72-25149*
US-PATENT-3,660,434 ..... N72-25148*
US-PATENT-3,660,851 ..... N72-25119*
US-PATENT-3,662,337 ..... N72-25210*
US-PATENT-3,662,441 ..... N72-25121*
US-PATENT-3,662,547 ..... N72-25455*
US-PATENT-3,662,604 ..... N72-25323*
US-PATENT-3,662,661 ..... N72-25842*
US-PATENT-3,662,744 ..... N72-25122*
US-PATENT-3,662,973 ..... N72-25595*
US-PATENT-3,663,346 ..... N72-25541*
US-PATENT-3,663,347 ..... N72-25540*
US-PATENT-3,663,464 ..... N72-25147*
US-PATENT-3,663,521 ..... N72-25152*
US-PATENT-3,663,753 ..... N72-25414*
US-PATENT-3,663,828 ..... N72-25262*
US-PATENT-3,663,839 ..... N72-25260*
US-PATENT-3,663,843 ..... N72-25255*
US-PATENT-3,663,885 ..... N72-25257*
US-PATENT-3,663,886 ..... N72-25258*
US-PATENT-3,663,929 ..... N72-25256*
US-PATENT-3,663,938 ..... N72-25020*
US-PATENT-3,663,940 ..... N72-25252*
US-PATENT-3,663,941 ..... N72-25253*
US-PATENT-3,663,944 ..... N72-25254*
US-PATENT-3,664,874 ..... N72-25259*
US-PATENT-3,665,064 ..... N72-25120*
US-PATENT-3,665,303 ..... N72-25211*
US-PATENT-3,665,307 ..... N72-25457*
US-PATENT-3,665,313 ..... N72-25173*
US-PATENT-3,665,417 ..... N72-25172*
US-PATENT-3,665,481 ..... N72-25174*
US-PATENT-3,665,589 ..... N72-25261*
US-PATENT-3,665,669 ..... N72-25454*
US-PATENT-3,665,670 ..... N72-25287*
US-PATENT-3,665,750 ..... N72-25913*
US-PATENT-3,665,751 ..... N72-25877*
US-PATENT-3,665,758 ..... N72-25288*
US-PATENT-3,666,051 ..... N72-25453*
US-PATENT-3,666,120 ..... N72-25021*
US-PATENT-3,666,631 ..... N72-25413*
US-PATENT-3,666,718 ..... N72-25151*
US-PATENT-3,666,741 ..... N72-25150*
US-PATENT-3,666,942 ..... N72-25146*
US-PATENT-3,667,010 ..... N72-25679*
US-PATENT-3,667,039 ..... N72-25680*
US-PATENT-3,667,044 ..... N72-25171*

USAFA-RR-71-10 ..... N72-25112 #

UU/CRG-71-3 ..... N72-25728 #

W-3993 ..... N72-25270*#
W-71003 ..... N72-25102*#

WASH-1505 ..... N72-25291 #

WHO-323 ..... N72-25591 #

WRE-TN-516-(T) ..... N72-25195 #

WTHD-35 ..... N72-25901 #

X-325-72-128 ..... N72-25861*#
X-550-71-496 ..... N72-25830*#
X-551-72-145 ..... N72-25825*#
X-552-72-9 ..... N72-25562*#
X-553-72-23 ..... N72-25860*#
X-553-72-94 ..... N72-25344*#
X-564-72-141 ..... N72-25828*#
X-621-72-107 ..... N72-25339*#
X-625-72-129 ..... N72-25341*#
X-630-72-49 ..... N72-25342*#
X-641-72-54 ..... N72-25647*#
X-641-72-133 ..... N72-25340*#
X-645-72-154 ..... N72-25829*#
X-645-72-176 ..... N72-25630*#
X-646-72-151 ..... N72-25832*#
X-651-72-186 ..... N72-25827*#
X-661-72-76 ..... N72-25724*#
X-661-72-124 ..... N72-25722*#
X-661-72-152 ..... N72-25723*#
X-693-72-71 ..... N72-25831*#
X-693-72-158 ..... N72-25826*#
X-751-71-384 ..... N72-25561*#
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Monitoring Earth Resources from Aircraft and Spacecraft (NASA SP-275)

By ROBERT N. COLWELL ET AL

This report by the director and other personnel of the University of California's Forestry Remote Sensing Laboratory first describes an experiment which sought to determine the extent to which the Earth's resources might be monitored by means of periodic inventories made with the aid of aerial and space photography. It then presents the results of that experiment in each of several geographic test areas in the United States. Special emphasis is given to vegetation resources. The final chapter summarizes the experimental results and discusses the feasibility of monitoring Earth resources by the methods described. 32 color plates. *Paperbound.* 180 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $4.00.

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